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July-August 2002

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In This Issue:

- ☑ 46th Annual AALS Convention — Evandale
- ☑ Build a 'No Dead Centre' Engine
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Front cover

Ian Davies' magnificent 5" gauge model of* Heavy Harry, *the only member of the Victorian Railways H class, won both the major awards at the recent Convention in Evandale. For more on the Convention turn to page 20. Photo: David Proctor

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Comment

Burnt fingers from Murphy's work!

Isn't it funny how that bloke 'Murphy', or at least his handy work, seems to turn up at the most inconvenient times when you're trying to get ready for something important and time is against you.

At the convention in Evandale I was assisting Wayne Bye raise steam in the *General** for the grand parade, which was to take place in a matter of hours. As this was the first time I'd driven doubled headed I was looking forward to a couple of practice laps driving Charlie Goodwin's engine coupled up to the *General* before pulling the official train.

Well, Wayne removed the external blower and turned on the engine's blower, you know the one that is supposed shoot a blast of steam from the blast pipe up the chimney and create a draft to make the fire draw better. Only trouble, this one was not! Steam and soot were being blasted through the tubes and out the fire hole. After a few ##*@*!# words, and thoughts of having to drop the fire I reached into the smoke box with a gloved hand and removed the steam pipe for the blower which was just swinging in the breeze inside. The pipe had fractured clean through. The external steam fitting was also removed, and both pieces cleaned up in the hope that we could get them silver soldered. Now only an hour or so from the grand parade.

Who would have thought that someone would just happen to have a stick of silver solder and a tin of flux in their car. Thankyou, who ever you are. Anyway, after much running about the offending pipe was repaired and after a few more ##*@*!# words I managed to get it reconnected. Even with a leather glove on it's still very hot inside the smoke box and it was impossible to see anything with the thick smoke in there.

Well, Wayne and I got in one practice lap before the official train was to be taken out.

If I may say, it was an honour and privilege to be asked to drive, this being my first convention. Thanks again to all at Evandale light Railway Society for a great time.

Ken Downs
North West Model Engineering Society
Tasmania.

* The *General* was owned by the late Greg Waddle from the Evandale club. It has had a colourful past being originally built in England and worked at the Penny Royal, a tourist attraction in Launceston before Greg acquired it.

(The above item was sent in by Ken as a short addendum to the Convention report. On reading it I thought that is a good comment on our hobby as it really captures the atmosphere of what does happen at the track and how there is always someone willing to help out ... Ed.)

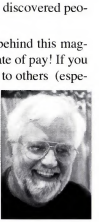
Join us in a great hobby!

If this is your first issue of *Australian Model Engineering*, welcome!

In successive issues we cover many topics centred on that wonderful process of model engineering — alias *tinkering*.

If you're new to model engineering as well as to our magazine, you'll benefit from getting together with other model engineers — we're good at sharing ideas and saving each other money! If you don't have any contacts, start by looking in Club Round-up to find a club that's near to you. Many of our readers have discovered people with similar interests literally just around the corner.

Helping other model engineers is the simple idea of the volunteers behind this magazine. Our readers write items for us — for the same (non-existent) rate of pay! If you have ideas, opinions or techniques that you feel would be interesting to others (especially from the newcomer's angle), please drop us a line. We can send you a useful guide and help with preparing artwork or editing.



I hope you'll enjoy the great fellowship that makes our hobby special, and that you'll support our advertisers — after all, they help pay our bills!

David Proctor
Managing Editor

Melbourne Society of Model & Experimental Engineers

Invite you to the

6th MODEL ENGINEERING EXHIBITION

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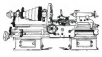

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A 'No Dead Centre' Engine

Story and photos by Bob Ellis

Drawings for publication by Clive Harnwell

The idea for the model came from a photograph of an old engraving of a 'No Dead Centre' engine in a book entitled *Power from Steam* by Richard L. Hills.

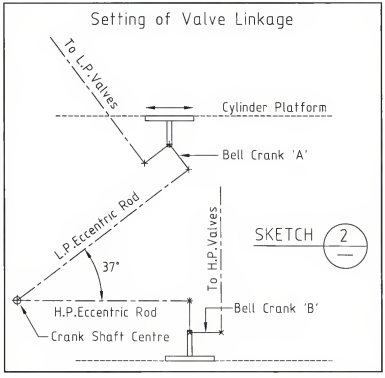
The general proportions of my model were scaled from this photo. It is fabricated from commercially available steel sections, machined and welded as necessary. The exceptions to this are the various bearings and bushes and piston rings, etc. which are all made from brass bar, and the fly wheel, which is an 'as-is' cast iron 'V' belt wheel, bushed to suit the crank shaft. The engine is a 2-cylinder double-acting compound and, as the photos show, it is a sort of 'V' twin, with vertical cylinders.

I decided to utilise a single eccentric for the valve gear which can be done if there is sufficient space within the confines of the engine frame. Generally, compound engines must have either 180° cranks or be tandem compounds to work with a single eccentric, i.e. pistons at opposite dead centres at the same time, or the same centres for tandem compounds.

With the engine the first step was to determine the number of crank shaft degrees between the highest point in the cylinder of the HP piston and the same point for the LP piston. (It cannot be called "Top Dead Centre" as this is a "No Dead Centre Engine"). This turned out to be 37° after the HP piston with anti-clock rotation, looking on fly wheel end. A second eccentric rod was then arranged as per **Sketch 1**.

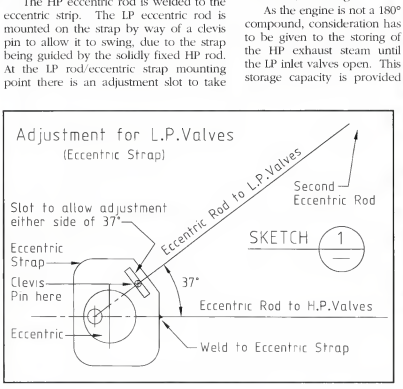
The HP eccentric rod is welded to the eccentric strip. The LP eccentric rod is mounted on the strap by way of a clevis pin to allow it to swing, due to the strap being guided by the solidly fixed HP rod. At the LP rod/eccentric strap mounting point there is an adjustment slot to take care of any final adjustments to valve settings (and it was n e e d e d !). Having set the eccentric to suit the HP valves it cannot then be moved on the shaft to suit the LP valves so the only way is to move the rod round the eccentric strap.

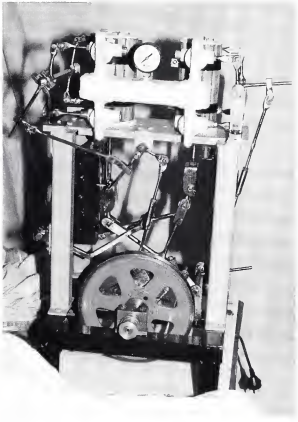
The relative positions of bell-cranks 'A' and 'B' in the valve gear system is also critical as per **Sketch 2**.

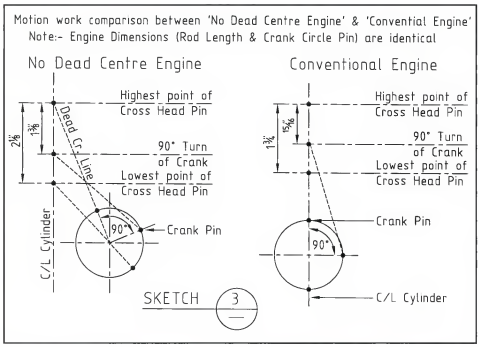


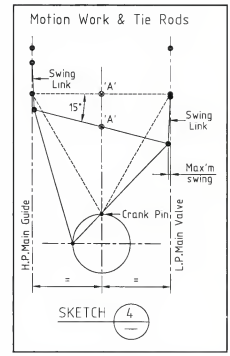
Crank 'B' is fixed and the position of 'A' was found by trial and error. The method was to slide the bell crank back and forth laterally as shown, by doubled ended arrow until the best valve setting was found. In effect this operation marginally alters the basic 37° setting.

As the engine is not a 180° compound, consideration has to be given to the storing of the HP exhaust steam until the LP inlet valves open. This storage capacity is provided by way of the manifold which connects the HP exhaust to the LP inlet valves. The volume of the manifold is such that it will contain steam to the quantity of $1\frac{1}{4}$ x HP









cylinder volume.

Observations on the engine when running show that it takes about two revolutions of the engine to raise the manifold pressure to a steady level of 1/4 x H.P. chest pressure. I am happy with this situation.

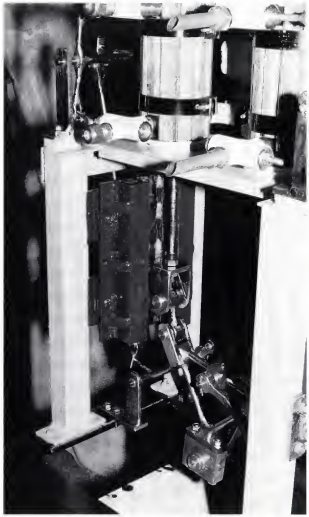
I don't think this type of engine has any practical advantage over the conventional types of the day and would probably be more expensive to produce which is probably the reason why only a few were ever built.

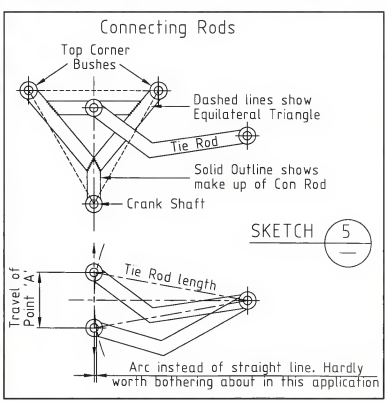
As for 'No Dead Centre", this seems to be a bit of a fallacy. A line drawn through the centre of the crosshead pin at the highest point, passing through the centre of the crank pin and the centre of the crank shaft will be a *straight* line as shown in **Sketch 3**. This would seem to be a definition of a 'Dead Centre'. While this situation obviously applies to the 'Conventional Engine' in **Sketch 3** it also applies to the "No Dead Centre Engine"!

The 'No Dead Centre Engine' has an increased piston travel compared to the 'Conventional Engine' which could be seen as an advantage, but on the other hand it has some pretty awful conrod angles (angle of conrod to piston rod).

The conrod is unusual, in that it is really two conrods in one as per **Sketch 4**, it is made from 3/8" diameter bar and has only one bottom end bearing.

Swing links connect the cross head pins with the top corner bushes of the tri-





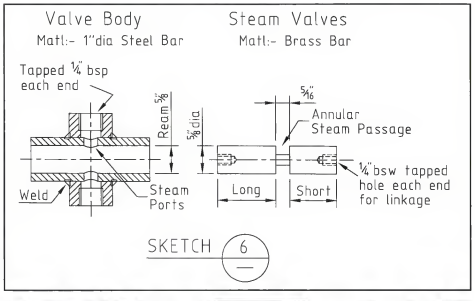
angular conrod. These links allow the top rail of the conrod to lie at a max angle of 15° approx to the horizontal at certain points of rotation. This angularity would have the effect of shortening the apparent horizontal length of the top rail of the conrod, thus making the engine unworkable if these links were not fitted due to the cross heads being drawn towards each other and jamming up in the guides (see **Sketch 4**). These links appear to have no effect on the 'No Dead Centre' aspect of things. A further point to note concerning the triangular conrod, is the attachment of two tie rods.

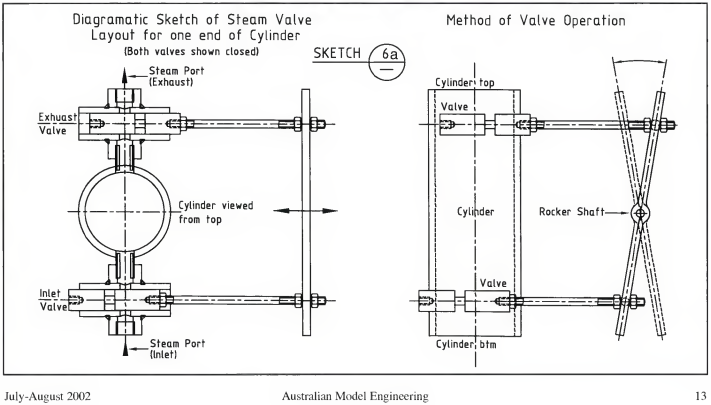
These rods run from the point 'A' on **Sketch 4** to mounting points on the outside of the vertical engine frame. The rods ensure that the mid point of the conrod top rail travels in a straight vertical line (or nearly so). They sort of compare to the tie links of Watts Parallel Link Motion as per bottom of **Sketch 5** and prevent the conrod from flopping about sideways.

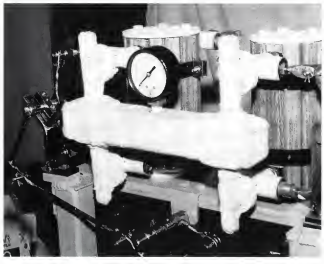
While the cross heads and guides are conventional, their operation is not. With a conventional engine, the slippers stay on the same guide face during both up and down strokes but with the 'No Dead Centre Engine' the slippers stay on the back face during the 'down' stroke and are pulled on to the front face during the 'up' stroke.

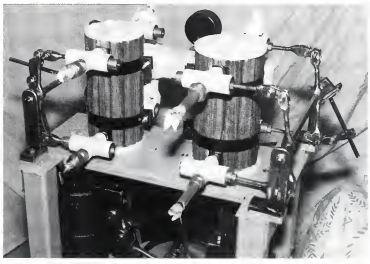
Each cylinder has four valves as per **Sketches 6 and 6a** with all being identical, the difference is in the set up. The inlet valves are the opposite way round to the exhaust valves. The valves are operated by a rocker shaft and links.

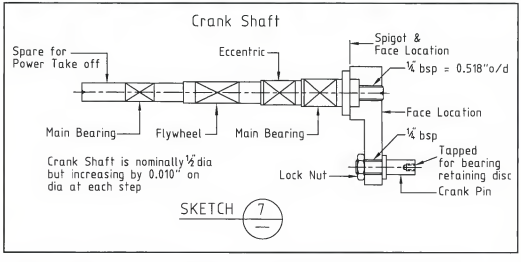
The pistons are 1/2" thick overall, with one 3/16" deep x 3/16" wide brass ring each. The pistons have loose junk rings and are secured to the rods with a nut above and below. These nuts pass into recesses in











the end covers. Both pistons are machined from steel plate.

The crank shaft is nominally 1/2" diameter but this dimension increases by a few thou progressively along the shaft at the points where main bearings, fly wheel and the eccentrics lie. This allows these parts to be removed along the shaft without scoring adjoining surfaces. The crank web is machined from a piece of 1" square bar as per **Sketch 7**.

The main bearings are brass bushes with a flange at each end for location in the bearing housings, which are split in the usual way. The bearing flanges provide end location for the crank shaft as necessary. The bottom end bearing is of similar construction to the main bearings. The use of BSP threads may seem strange on a crank shaft but 1/4 BSP is the only suitable fine thread tap I possess. The male threads were screw cut in the lathe. The screwing of the crank web is of course of the correct 'hand' (RH) to cause it to tighten on the shaft rather than unscrew as the engine runs.

In conclusion, the engine runs happily at 100 - 300 RPM but had to have balance weights fitted to the flywheel (4 1/2 lb lead) to stop it from jumping around. Any out-of-balance is more pronounced on a vertical engine. The engine has been tested on a home made brake set up consisting of friction drum and torque arm and a set of kitchen scales graduated in ounces. The RPM of the engine was checked against a wrist watch.

The results were:

RPM = 280

Chest Pressure = 28 psi (comp. air)

LP = 6 psi

BHP = .03

I doubt if the results are too accurate due to my methods and the accuracy, or lack of it, of the scales. This engine was commenced some 2 years ago but due to unavailability of some materials (I couldn't get them cheap) it had to be shelved for a while. The dimensions of the engine are:-

Piston stroke HP and LP = 4 3/4"

Crankpin circle = 4" dia

HP cyl. dia = 1 1/2"

LP cyl dia.= 2"

Engine height = 29"

Engine length = 17"

Engine width = 14 1/2"

In conclusion it has been a most absorbing project, and would be of interest to the other contraption builders among us!

Steam Chest

with Dave Harper

Hi there steam fans, and welcome to another load of ebullition from the steam chest. I have lots of good things to share with you this time, so here goes....

Firstly, a very prompt response from now regular correspondent, Jim Libby. Jim was able to clear up the mystery of the strange domed gadget in the photo of the Mossman Sugar Mill engine shown in photo 6 last issue.

Apparently it is a pneumatically operated control valve that is probably used to control the downstream steam pressure. As Jim says, it seems strange that they should need the control valve as well as the centrifugal governor, but he guesses that the steam supply pressure may vary too quickly for the governor to respond adequately.

My guess is that it is to enable the speed of the engine to be controlled remotely from the air conditioned control room rather than have to go down to the engine to do it. This fits in with the preferred operating methods now used, and was probably an interim measure until the steam turbine could be installed in place of the reciprocating engine. More efficient, but very dull! And excruciatingly noisy.

Flashback to Charters Towers

Jim also commented on the half beams of the Hathorn Davey pumping engines in figure 2 (last issue). They are intended to keep the piston rods travelling in a true straight line, rather than using sliding cross-heads. I suspect they were easier and cheaper to produce and maintain on these huge engines than any sliding crosshead arrangement. Also, when marketing these engines to water supply engineers, the beam arrangements were probably comfortably familiar to those conservative men, and were easier to sell than new-fangled crossheads! The incredibly complex linkages to the differential engines wouldn't have fazed those Victorian engineers, mechanical complexity was the name of the game in those days.

For those who missed the 'Travels with Kenny' series, I've dug out some photos of the Charters Towers engines — **photo 1** shows one of the pair of engines and pumps. To give an idea of scale, the fluted columns supporting the entablature are about five feet high. The cylinder bores are 37" and 21" and the stroke is 5' 6". Speed was 9 strokes per minute at approx 50 psi and the pumping rate was 20,000 gallons per hour.

Photo 2 is a closer view of the differential engine which controls the speed of the pumps and also guards against uncon-

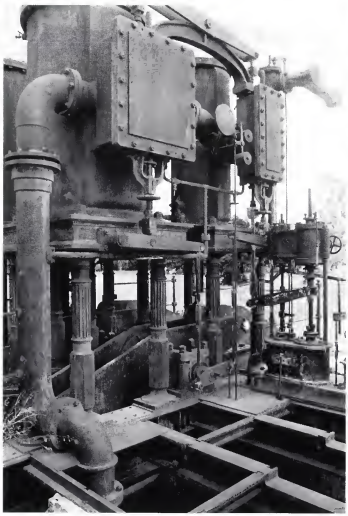


Photo 1

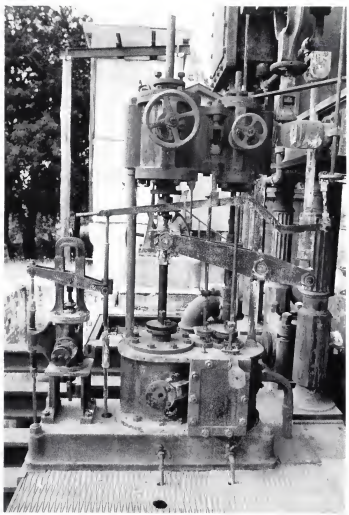


Photo 2

trolled runaway should something break — a very real concern in those days of cast iron beams.

Photo 3 is a close up of one of the half beams and its link — note the fluted columns and cast stanchions for the hand rail, typical Victorian touches.

It will also be noted that most of the tread plates are missing from around the engine. We were told that half the houses in Charters Towers acquired barbeque plates when the engines were taken out of commission! It sure made getting around the engines exciting, as the pump wells below are about 25 feet deep — no place for the faint hearted.

The valve gear is listed as being 'slide valves with Meyer expansion gear controlled by Davey differential engines' — complicated enough for any man.

I retrieved this information from an article by Owen Peake that was published in the *Journal of the International Stationary Steam Engine Society* (ISSES) and kindly sent to me by Peter Lukey before Ken and I went on our trip up north. There is a whole bunch of other stuff in with this article — drawings of other engines and descriptions of the differential gear, etc. After studying it all over quite a period I was none the wiser. However, I felt better after I found out that neither were Owen or Peter!

If anyone would like a copy of all this contact me and I'll see what can be done.

But wait — there's more!

From Jim Libby, that is.... way back in *AME* No 90 I included a drawing of a centrifugal pump and its little steam engine. The drawings came from copies sent to me by Allan Wilson as being out of an old text book on engineering drawing.

Jim picked this up whilst browsing recently, and recognised the drawings as being similar to some in his own library. On checking up, Jim realised that his book has three parts, totalling over 200 pages, and the drawings I described came from Part Three. The book was published in 1909 and goes under the snappy title *Machine Drawing for the use of Engineering Students in Science and Technical Schools and Colleges*.

The most amazing bit I find is the little note at the top of the title page: "Price in limp cloth 3s, postage 4d"! This is for an A4 sized

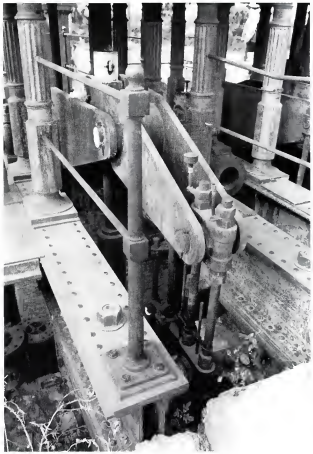


Photo 3

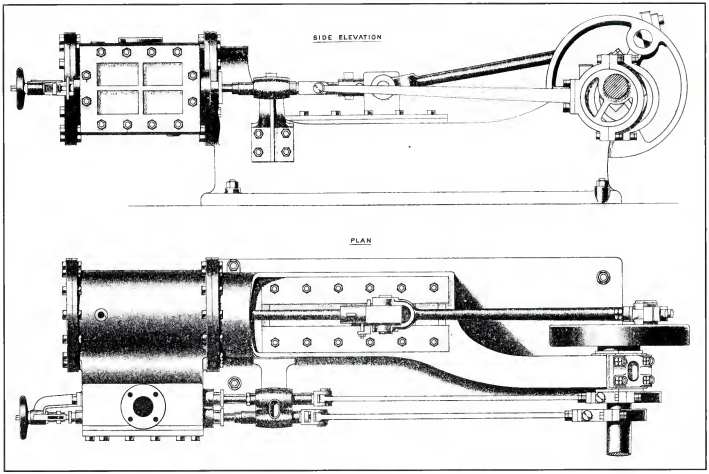


Figure 1

book of 200+ pages.

Jim sent me the index pages for all three parts, and this verifies the fact that I have part three. From among the mouth-watering selection in the other two parts Jim sent me the sheets relevant to the delightful single cylinder horizontal engine shown in **figure 1.** This is one of the tinted drawings that feature in the book, hence the shading effects, real masterpieces of the draughtsman's art.

The engine has a bore of 12" and 20" stroke, and has variable expansion gear that looks very much like Meyers' gear to

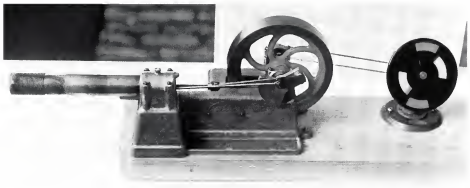


Photo 6

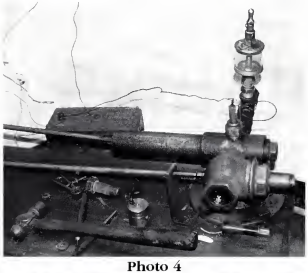


Photo 4

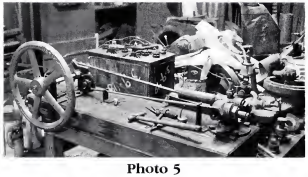


Photo 5

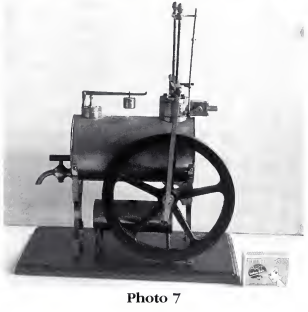


Photo 7

me. This would appear to be tailor-made to be scaled down in model form. An SAE will get you the other pages with enough details to build a model.

This isn't steam, but...

I also heard again from Tony Little up in Chillagoe. Tony responded to my plea for photographs by sending me some shots of his latest project. Tony wrote:

"It isn't actually a model, and it's not steam either, but it is made mostly from old steam and plumbing fittings (even the flywheel). It certainly doesn't look like a four stroke petrol engine, but it's actually a reasonably close replica of Henry Ford's first experimental engine, first run in 1893.

I have to admit I had very grave doubts that it would run at all and if it did it would not be controllable, and would fly to pieces. It's proven me wrong on all counts and actually runs quite well, even if it doesn't have much more power than a comparable hot air engine. Since being built it has run in excess of 25 hours so it is reasonably reliable. The main problem was getting the valves to seat 100% as it can't stand any leakage in this area at all.

I think the ex Briggs and Stratton timing gears are about the only bits actually doing the job they were intended to do! I had to modify some dimensions to suit the available 'resource supply' (scrap bin) but I think I finished up with a reasonably accurate copy. The combination fuel tank/fuel gauge/carburettor and fuel tap was certainly innovative! (It's also the cylinder lube system as I run it on two-stroke mixture). I hope this is of interest to you..."

It certainly is, Tony! As **photos 4 and 5** show, it's a brilliant bit of improvisation that would make any model engineer proud!

Tony included a copy of the drawing that he used, taken from *A Treasury of Early American Automobiles 1877 - 1925* by Floyd Clymer published in 1950. Unfortunately the copy is too faint to reproduce, but it shows that Tony definitely got it pretty right. He says it's been variously called a plumbers' nightmare and a pipe dream, but hey, it works! That workshop sure looks lived in, Tony, you don't have to apologise for it.

And neither is this...

Another interesting engine that came my way recently belongs to Clinton Taylor, who actually lives just a few streets away from me. That made it very easy for me to pop round with the camera and snap this beautiful hot air engine — see **photo 6.**

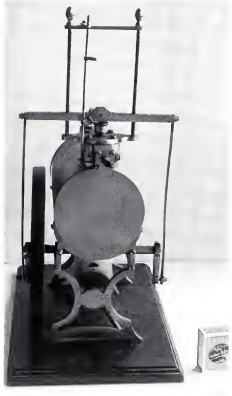


Photo 8

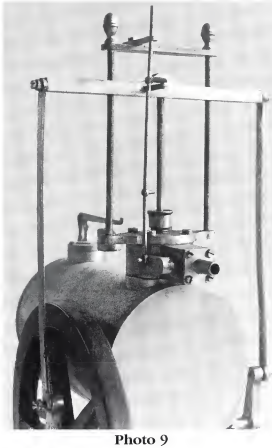


Photo 9

The interesting thing about it is that it was made by Peter Olds of Maryborough, Qld. The plate on the base reads:

Made for Robert B. Huxtable, Lansing, Michigan U.S.A. The Huxtable Hot Air Engine manufactured by William Olds & Sons Pty Ltd., Maryborough, Qld, Australia. Good one, Peter. Can you tell us the story on this one?

The flywheel is about 6" dia and the heating tube about 1" dia. When warmed up with a butane torch the engine runs very sweetly, and drives the rotating coloured disk to intrigue passers by at the Bracken Ridge track on steaming days.

Another very old engine

A welcome visitor at the Boiler House recently introduced himself as David Dettmar, who also lives here in Brisbane. David told me that he has an old model steam engine inherited from his father, that originally belonged to none other than J N Maskelyne, well known for his writings in *Model Engineer*. Apparently David's father knew Maskelyne, and by some means unknown came to possess the engine in question. As can be seen in **photos 7, 8 and 9** it has a very Trevithick look about it, with the cylinder inside the boiler and crosshead running on vertical round bars.

The engine was originally featured in an article by Maskelyne in *ME* of 15 Dec 1960, and he described it thus: 'the first thing that is apparent is the basic simplicity of the design; except for the cast-iron flywheel and the wooden bedplate the whole engine and boiler are made of brass, though the slide bars and piston-rod are of steel. The boiler barrel seems to be a brass casting with the ends brazed on; it is supported by a cast brass standard at each end, fixed to the bedplate by screws from underneath. At the upper end of the standards, screws are let through the standard arms into the boiler barrel to hold it rigid.'

The cylinder is mounted in the boiler, and the crosshead bars are supported by a brass plate bolted onto the cylinder top. The valve is operated by a 'plug rod' in the manner of the old beam engines, simply flicking the valve over at the end of each stroke. **Photo 9** shows this quite clearly.

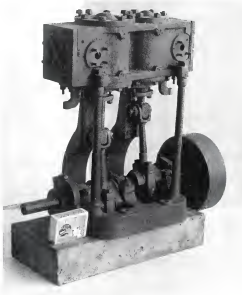


Photo 10

There is a simple weighted safety valve, but no steam cock, so speed was solely governed by the pressure! Mr Maskelyne wasn't much taken by the safety features, but we all agree that it is a very interesting model, and is probably well over 100 years old. Amazingly, it runs quite sweetly on a few pounds of compressed air. David hasn't been game to fire up the boiler.

David also showed me another interesting old, but incomplete model in his possession. It is a compound marine engine, quite a hefty model with bores of $1\frac{1}{2}$" and $2\frac{1}{4}$" and a stroke of $1\frac{1}{2}$". At that size, it would probably power quite a fair sized launch. David would be interested if anyone could shed any light on the origins of this engine, as it doesn't appear to have any maker's marks on it... I'll pass on any

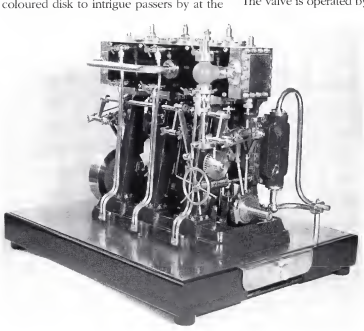


Photo 11

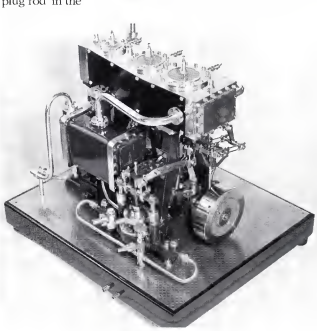


Photo 12

information. **Photo 10** shows the engine in question.

Pictures from across the Tasman

Another reader who responded to my plea for photos was Graham Quayle from Auckland, NZ. In earlier correspondence, Graham had told me he was building a Bolton triple expansion marine engine, and he was able to send me some pictures of the completed model this time. **Photos 11 and 12** show the front and rear respectively of the model. From the pictures it is apparent that Graham has produced a magnificent model as well as being no slouch as a photographer. **Photo 13** is a close-up of the works, and clearly shows the fine detail that Graham has put into the model. Well done, Graham!

Alert readers may have noticed that one of our advertisers, Minitech, in *AME* no 102, p66, advertised some new steam engine kits from Quayle Designs. Well, Graham is THAT Quayle!

Graham has produced two designs using all bar stock, i.e. no castings, that can each be built in three different ways, horizontal and vertical singles and a vertical twin. They are produced in two different sizes, 16mm bore and stroke and 20mm bore and stroke. **Photo 14** shows the three 20/20 engines — note that even the flywheels are fabricated.

Some time ago Graham sent me a kit for review, which I passed on to Paul Knight at Minitech, who has obviously taken them on board as a stock item. The review kit is currently being made up by one of our local modellers, and a full review will appear in these pages in due course. I have to admit that I passed on the job of building the review kit as I have too many other projects on the go, and the volunteer whose name will be revealed in time is far better qualified than I am to do the job.

What I can say now is that I was very impressed with the completeness of the kit I saw. The comprehensive instructions, together with the detailed drawings, would enable any beginner to tackle the model with confidence. All material and fasteners are provided, even down to a pre-cut wooden base. Only a few metric taps and dies are required beyond a basic lathe and hand tools to complete a model that anyone would be proud of.

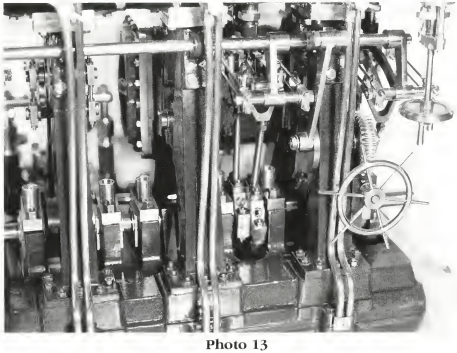


Photo 13

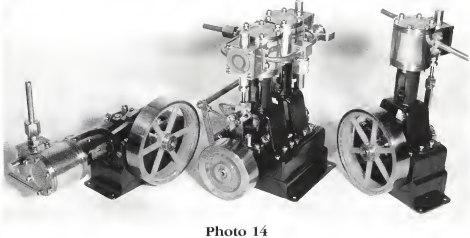


Photo 14

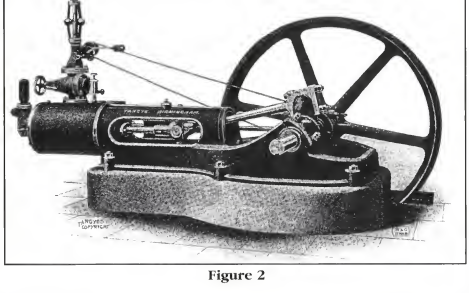


Figure 2

A Tangye to terminate

As a final offering for this time, here's another item from the old Tangye catalogue kindly sent to me by Jim Libby. It's the Colonial steam engine (**figure 2**) which bears more than a passing resemblance to the engine in **figure 1**, except that it has a trunk crosshead guide and double crankshaft bearings. Tangye's 'Quickspeed' governor and no expansion gear. These engines were available in sizes from 5" bore x 7" stroke up to 12" x 18" and were rated from 6½ to 45 bhp at 100 psi. steam pressure. The 'Quickspeed' governor had combined equilibrium throttle and stop valves — does anyone have any drawings of this sort of governor? Over to you...until next time, happy steaming!

You can email Dave at:
sandave@bytesite.com.au

46th AALS Annual Convention

Evandale, Tasmania — Easter 2002

by David Proctor

Photos by the author unless credited otherwise

An overseas Australian convention — how exciting! (For overseas readers who may not be aware, Tasmania is Australia's island state, separated from the mainland by the few hundred kilometer wide Bass Strait). After an uneventful flight we were met at Launceston airport and driven to the nearby historic village of Evandale. Evandale would have to be one of the best preserved Victorian era towns in Australia, with most buildings dating from the 1800s, some as early as 1809. Our accommodation was at the Clarendon Arms Hotel, a small building dating from around 1847 and only five minutes walk from the Convention site.

Even though it was only Wednesday we decided to take the short walk to the track to see what was happening. As many readers of *AME* will already be aware, The Evandale Light Railway and Steam Society's track is in the grounds of *Greg and Gill's Place*, the home of Gill Waddle. Gill's husband Greg was the driving force behind the club, a versatile modeller, artist of note and art teacher. Greg's dream was to see the club host an event of the calibre of the AALS Convention but unfortunately he passed away only 5 months beforehand. The club has operated a dual gauge 5"/7¼" ground level track and an elevated 3½"/5" track for many years. A couple of years ago Club President Geoff Baumgartner donated his 5" ground level track to the club (see *Geoff's Track, AME* issue 90) and this has now been connected up to the original dual gauge track. Drivers of 5" trains can travel a circuit of about 1¼ kilometres

Early morning on the steaming bays for the 5" ground level track. Mark Robinson and Paul Gray are deep in converstaion while Helmut Ecker and others get ready for a day of fun

Hailing from Hobart, Derek Sandle's 5" Marie E *has a rest on the elevated track*

John Hagan lights up his GWR Loma Doone Photo: John Vincent

The early colours of autumn provide the perfect backdrop

This gentleman was doomed to forever row his lady around the lake

Bill Chalmers brought his 3½" LNER Pacific Photo: John Vincent

by using both tracks. (A track plan appears on page 42 of *AME* issue 98). When we arrived we noted that a couple of visitors from the mainland were already there and the locals were making last minute adjustments to the new connecting trackwork.

Thursday

On Thursday morning we were given a lift into Launceston by Diane Lawson, half of the Convention Convenor team, with the idea that we could do a bit of sightseeing and return to Evandale in the afternoon when the Registration van was open for business. We visited the site of the old TGR workshops which is now part of a museum and cultural centre and explored a few spots around the city all of which will be included in a separate article in the next issue of *AME*. It must be said that it would be very hard to find people anywhere who are generally more friendly and helpful than the ones we met everywhere we went in Tasmania.

Thursday evening was the first real opportunity for old friends to meet again as they gathered in the Memorial Hall, a few minutes walk from the track, for the Civic Reception. It was a most enjoyable night as the food kept coming while people swapped stories and compared their Tasmanian itineries. Most of the visitors from the mainland went to Tasmania with the idea of having an extended holiday while they were there. My friends and I planned to travel to the various steam sites the state had to offer during the week following the Convention. Others had done the tourist bit first so were able to offer the benefit of their experiences.

This nicely finished 7¼" gauge TGR ZA class belongs to local member, J McLachlan

The other end of a business-like lash-up is Jock McLachlan's equally impressive Z class

Friday

The first day of the Convention started with a cool wind blowing and when I arrived at the track the ground level 5" steaming bays were a hive of activity while the others were a bit slower to get started. The 5" steaming bays are on a lower level than the track and there is a very interesting, rather steep line connecting the two. It could double as a ski jump but when we tried to organize a competition to see who could come down the hill the fastest and clear the fence into the adjacent paddock, there was a surprising lack of enthusiasm. The club has three sets of steaming bays as there are separate ones for the dual gauge track and for the elevated track.

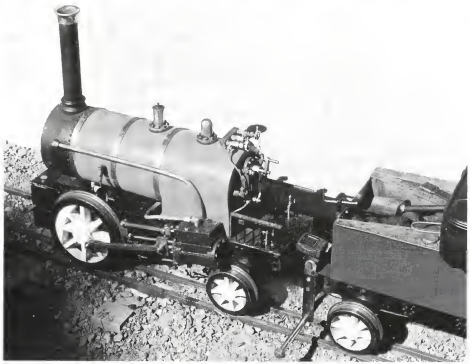
My first priority was to locate the tent which had been erected for displaying the entries in the **AME Under 25 Encouragement Award**, and organize the displays. Five entry forms had been submitted —

- Paul Gray (Newcastle, NSW) — 5" gauge NSWGR Z class flat wagon
- Marcus Ritson (Launceston, Tas) — 1/6th scale Otto & Langden atmospheric gas engine
- Ryan O'Halloran (Edmonton, Qld) — Stirling Cycle Engine
- Andrew Allison (Sydney, NSW) — 1½" scale Westinghouse air compressor (water pump)
- Mark Loan (Mole Creek, Tas) — 3-truck Heisler locomotive

Ryan O'Halloran's engine had been sent by Registered Post and was posted

A nice little 5" GWR Pannier tank in the elevated steaming bays

Here's trouble! John Wakefield gives Joe Huntley for a tour of the track



Shane Ferris brought his old style 7¼" gauge Northumbrian *down from Brisbane*

Helmut Ecker from Wollongong with his Baldwin Mogul Photo: John Vincent

about two weeks before the Convention, but unfortunately did not arrive. It eventually turned up the middle of the week after the Convention and was mailed back to Queensland. On the return trip it was posted on Friday and Australia Post managed to deliver it first thing Monday morning! Figure that one out!

On walking around looking for good photo spots I was struck by the glorious setting this club has. There is a dam, a boat pond (complete with lighthouse, jetty and narrow gauge railway), beautiful grounds, peat trees loaded with fruit and a lovely outlook across rural Tasmania to the distant mountains. On the down side, the layout and the trees meant that it was not easy to find spots where the light was in the right place throughout the day for photographs. Needless to say, some good positions were found.

One loco spotted very early was Ian Davies' outstanding 5" gauge model of Victoria's H class loco *Heavy Harry*. After a bit of serious thinking a good spot was found to get some shots of it, one of which features on the front cover. Before long the 5" track was very busy and there were smiles in every direction. At times the track gang could be seen making some fine tuning adjustments as the new track settled down. The amount of track laid by the members of ELRSS in so short a time is a remarkable achievement and they are to be congratulated. As is usual, I spent as much time the first day getting as many photos as I could in case the weather changed during the weekend (a lesson from being caught out one year). Lunch each day was obtained from the food shop in the adjacent market complex, although the markets were only on Sunday.

The AMBSC Annual General Meeting on Friday night must be a record as it was all over in ten minutes. Most of the boiler issues of the last year had already been resolved by postal ballot.

Saturday

Another perfect day — the locals tell me it is always like this in Tasmania and I'm sure they wouldn't lie! The camera and note book were again kept busy between admiring various works of art and

socializing. Many people probably would not think of our models as art but when you think about it, that is just what they are. It was a pleasure to meet up with good friend (*and AME draftsman extroadinaire*) Jim Gray who is a member of the local club. Two unusual locomotives which particularly caught my eye were seen to be double heading throughout the day. These were John Hagan's lovely old GWR Armstrong class *Gooch* (4-4-2) and Achilles class *Lorna Doone* (4-2-2), driven by John and son Bruce.

I missed out on some good shots of these and a few other models over the weekend as I discovered after I got home that the exposure my camera had been misbehaving periodically. There were very few large locos from the mainland due to the cost of transport across Bass Strait. Present were Linda Hall's Porter *Lindy Loo*, John Steadman's *Heidi I*, Ron May's *Oakstream*, and the Clarke Hunslet *Guynear*. Locomotives registered comprised 11 in $7\frac{1}{4}$", 27 in 5" and 3 in $3\frac{1}{2}$", 41 in total.

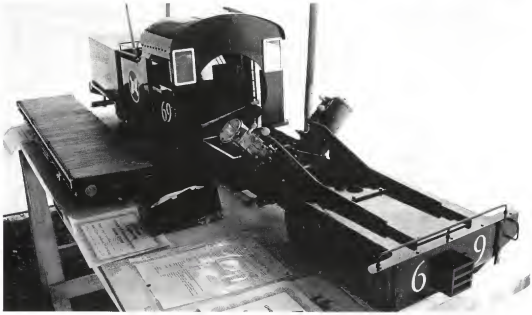
The Convention was officially opened after lunch by Don McShane, the Deputy Mayor of the Northern Midland Council. The official train then did a circuit of the track, after which I went off to organize the judging of the *AME* Under 25 entries.

As was the case every evening everyone headed to the Memorial Hall for the evening meal, and this evening it was followed by the AALS AGM. Unlike the previous night this one lasted a bit longer (a bit over an hour) as there were a couple of contentious issues up for discussion. Peter Manning was re-elected as Secretary and Ross Walker as Treasurer for a further three years.

Sunday

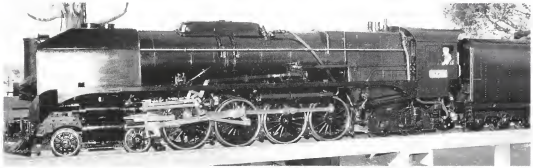
Market day! The Evandale Sunday Markets in Falls Park (in front of the ELRSS track site) are well known throughout the state and well patronized. Because of the club's regular involvement with the markets, Sunday morning was set aside for public running. The markets were large, heaps of stalls and no doubt many dollars were extracted from convention goers as several were seen

Would it be a Convention without John Steadman and his Heidi, which as usual, was in steam all weekend.



Paul Gray's flat wagon and Mark Loan's Heisler were two of the AME Under 25 entries

Ken Downs from NWMES at Ulverstone drives Chas Goodwin's Dundas



Ian Davies won two major awards with this 5" gauge Victorian Railways H220 Photo: John Vincent

The island on which the lighthouse sits has an '0' gauge track around it

The Clark family brought Hunslet Gwyneat *over from Gippsland in Victoria*

wandering through the markets and returning with bargains. It was another glorious day and early on the agenda was the AALS Insurance meeting where there was some discussion on being safe in what we do and on the current climate in the insurance industry. By mid morning there was a fair amount of activity around the boat pond. Seen on the water was an ingenious row boat where a rather unhappy looking man was rowing his lady around the lake. The boat was propelled by the oars and was built by Greg Waddle. I believe there was a guide rail under the water, straddled by a couple of pieces of wire suspended from the bottom of the boat to make sure that the rower did not stray too far from his intended course. Also afloat were some rather nice boats and an exquisite steam launch, mostly from Hobart where there is a very active model boat club. An article on this club appeared in issue 95 of *AME*. An oversize whale was swimming around, winking its eyes and spouting water at regular intervals.

As usual at the Convention, Sunday is Bogie Night (the AALS equivalent of television's Logie Awards). The Awards were as follows

- **Bolton Trophy** (E & J Winter) — Ian Davies for his 5" *Heavy Harry*.
- **Southern Federation Award** — Chas Goodwin (NWMES and ELRSS).
- **Sydney SME trophy for the Most Popular Loco** — Ian Davies for *Heavy Harry*.
- **AME Under 25 Award** — Marcus Ritson for his Otto & Langden atmospheric gas engine.

In addition, in recognition of their regular attendance at our Conventions, Fred and Dale Springer of Texas, USA were presented with certificates proclaiming them as Honorary Australia Live Steamers.

An outstanding model of the GE Tram by Grahame Seabrook of Hobart

Under 25 entrant, Marcus Ritson's award winning Otto & Langden atmospheric gas engine.

Monday

After taking some photos of Graeme Reardon's 7¼" TGR 'Y' class diesel locomotive for an upcoming article I was privileged to be able to view Greg Waddle's amazing collection of, well everything — Matchbox, railway, cars, aeroplanes, cameras, photographic, spark plugs plus much, much more. The man was an avid collector of nearly everything imaginable.

I then spent the rest of the day away from the Convention site in the very pleasant company of Jim and Marg Gray who showed me the sights around the Tamar including Grindelwald, a resort village in which all the buildings are supposed to look like traditional Swiss ones, a lookout with magnificent views up and down the Tamar and a most enjoyable lunch at their home. After lunch and a bit more sightseeing it was back to the track for a farewell evening BBQ, the perfect end to a great weekend.

The members of the Evandale club are to be congratulated on staging a terrific convention and I am sure everyone who attended will be hoping that this will be the first of many overseas Aussie conventions. The meals were superb and the organisation was marvellous. Convenors Peter and Diane Lawson did an outstanding job of arranging and bringing it all together and they were also very helpful to *AME* on several occasions. Thankyou both very much.

Next year the convention will be at Penfield in South Australia. We hope to see you all there.

The next morning we left Evandale as we headed off on a trip which would include many of the steam sites in Tasmania. You can read about the Abt Wilderness Railway, the Bush Mill and more in the next issue.

Graeme Reardon's TGR 'Y' class loco will be the subject of a future article in AME

Melanie Dennis takes her 'Blowie' for a 'fly' around the track! Photo: John Vincent

Barry Glover is about to present Fred and Dale Springer of Texas, USA with certificates acknowledging their regular visits to Aussie Conventions

Chas Goodwin proudly holds the Southern Federation Trophy

Making Injectors

Part 2 — Making Gauges and Mixing Cones

by Ted Crawford

Drawings for publication by Rex Swensen

Plug and other gauges

Where reaming until a specified input diameter is required, a double ended plug gauge is best made first, one end about 5 thou smaller than the finished size and the other perhaps 1 thou under size. When the 5 thou under gauge can just go in the reaming will be nearly finished, so go easy until the 1 thou under size just clicks in. Mark the gauge to distinguish the ends, e.g. a long black mark for 5 under and a short black mark for 1 under.

One way to measure the diameter of the entrance to a cone is to turn a bit of round stock to a smooth taper at a much steeper angle than the cone, say at about 20°, blacken it with ink, introduce it into the hole, and twist it to get a witness mark from the hole edge. The diameter can then be measured with a Vernier or micrometer.

Don't rely upon an end stop if one is used, until it has been **proved** to limit at the correct size, as the reamers have a habit of cutting slightly larger than their measured widths.

A handy throat depth gauge

Knowing the actual position of the throat is essential so that the reaming depth can be progressed. In production a dozen experimental trials with the reamer can enable a depth stop to be set, but for the amateur it is better to use a throat depth gauge and one suitable for a particular throat size is a plug gauge made 1 thou oversize. The gauge will stop at 6 thou from the throat if the angle is 9° or at 10 thou if 6°.

Making a small diameter gauge may be a problem. But a slow taper made the same as the next to be described but terminating with a squared end of the needed throat oversize diameter is fairly easy. Alternatively the sewing box may provide a needle that can be used with the point ground off.

Another variety with more versatility and useable for different size throats is described next.

Two inches or so of $\frac{1}{8}$" brass or brazing rod is suitable for this gauge which can be formed by turning with a very sharp round nosed tool or by filing. For this short length, filing may be the faster method.

The object is to form a smooth taper of 75 to 80 thou per inch starting from the stock width of 125 thou down to 10 thou less than the smallest throat size of interest. The taper is based on an angle of 4.5° to 4.75°, which is more than a degree less than any reamed angle likely to be used.

For turning the gauge, the top slide is first rotated anti-clock to 2.25 or so degrees. The work will have to be done in short stages of length due to flexing of the stock, taking care to maintain a continuous taper. The tool height should have no more than the smallest negative error if any. It will probably be easiest to finish off by filing.

For filing, the work is similarly progressed in length and the job is finished with a smooth file with strokes angled across and along the work away from the chuck to generate a smooth and ripple free finish.

A typical finished length for the gauge is 1.3 starting from a diameter of 125 thou at the base and tapering down to 20 thou. Cut a narrow groove near the base to act as a reference mark.

To use the gauge first put the point into a throat sized hole up to the limit set by the taper and, with the aid of marker ink, scribe a line to mark the throat diameter position. Make a note of the distance of this from the reference mark or the point. As reaming progresses the distance from the end of the cone to the throat mark is monitored by inserting the gauge until the throat limit is felt, marking the position of the cone input end, withdrawing it and measuring the distance to the throat mark. A firmly held thumbnail can be used for the outer mark in the first instance but a small pair of fine nosed pliers held firmly up to the cone is more stable. Errors in the measurement reflect on the throat length accuracy. With care, a steel rule can measure to the nearest 5 thou. ($\frac{1}{3}$ of $\frac{1}{64}$" or $\frac{1}{8}$ of 1 mm)

Knowing the depth of the throat is the only way to avoid either enlarging it's size or leaving it too long.

It should be realised that getting the throat to the right diameter at the correct depth will result in the input diameter being correct only if the reamer is cutting **exactly to the true angle**. That problem is examined in the making of a mixing cone later.

Throat length

The throat is the smallest internal diameter of a cone and is at the output end of the mixing cone, about 20% of the total length from the output end of the steam cone (at the beginning of the nozzle expansion) and about 3 to 20% from the input end of the output cone.

Most model injector designs show a throat length of almost zero, with a minute parallel portion if any, and this can only be obtained by reaming with zero tolerance tools and to zero tolerance depths unless very precise measurements are made while the work is in progress. If these conditions are not met the throat will be too short or will have a long parallel length due to under reaming or will be oversized due to over reaming.

Such exact precision to obtain near zero throat length is unnecessary as experiments show. The results of these are that if **T** is the throat diameter, throat lengths up to 5/4 times **T** can be used for the steam cone without significantly affecting the steam flow and the mixing and output cones usually perform just as well with throat lengths up to **T**.

For those reasons it is recommended that where the drawing or design specifies or implies an almost zero throat length then a minimum target length of 20 thou and a maximum of **T** for the mixing and output cones and a maximum of **5/4 T** for the steam cone should be used. The expression target length is used because of practical measurement difficulties which could lead to an apparent measured 20 thou actually being nearer 10 thou.

NOTE: in the following cone notes, where the example OD is 250 thou, if the body bore actually used is a bit different, e.g. 6 mm or Letter G drill size, then substitute the size used for 250 thou.

The mixing cone

(See **Figure 7**) This cone should be made and assembled in the body before starting on the steam and output cones. It has an internal taper reducing from the input to the throat which is typically shown to have zero length. About 40% from the input the taper is interrupted by a gap which makes starting possible by enabling a temporary escape of fluids through the turret ball valve. This escape is made easier by broadening the gap when it is clear of the taper. Unlike the other two cones this one has to have both end diameters correct and this needs the most accurately angled reamer and careful monitoring of progress.

Dimensions needed with examples. The most critical, nearly all of them, are marked with *.

* **Pressed Depth from steam end of body 600 thou** (Controls steam cone penetration)

* **Length L = 600 thou**

* **OD** Light press fit in the bore **250.25 +0, -0.1 thou**. Checked by trial. For a Body drilled with 250 thou. Use alternative OD to suit the body drilling used. The same will apply to the other

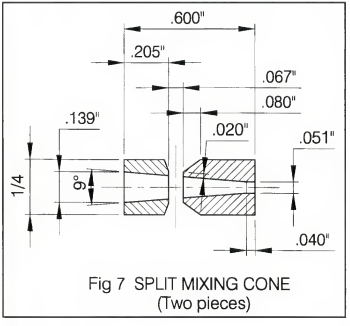


Fig 7 SPLIT MIXING CONE
(Two pieces)

cones.

* **Throat T = 51.2 thou** or 1.3 mm. No. 55 is 52 thou but No. 56 is 46.5 thou, too big a big step!

Throat length **tl** = 40 thou nominal

* **Reamer angle A = 9°** +/- 0.1° if possible but up to +/- 0.5° with correcting measures.

* **Input Id 139 thou**. Most designs require this to be calculated.

* **Overflow gap** Starts at **205 thou** from steam end of cone.

* **Width 67 thou** or 1.7 mm

Gap flared out to the ball valve. If a two section cone is made then leave enough metal around reamed bore on the output section e.g. 20 thou to withstand pressing.

Input section edge rounding 10 thou max. Typical only, not required for the example.

Output section edge rounding 10 thou max. Typical only, not required for the example.

Calculations

* **Input diameter Id** = T + (L - tl) x Tan A: needed if **Id** is not included in the data.

If **tl** is not specified, assume **tl** = 0 for calculations only.

Example with A= 9°. **Id** = 51.2 + (600 - 40) x 0.157 = **139** thou

If a cone is to be copied, and **A** is unknown but **Id**, **L**, **tl** and **T** can be measured:

A= 2 x Tan^{-1} ((Id - T) /(2 x (L - tl))) = 8.95 degrees. Tan-1 is the same as Atan or Atn or ArcTan.

Or, if d1 and d2 are known internal diameters spaced L2 apart then A= 2 x Tan^{-1} ((d1-d2) /(2 x L2))

Whole or occasionally $^1/_2$ degrees are always used so 8.95° would actually be 9°. Note that twice the $^1/_2$ angle was calculated, as this gives the most accurate result.

Making a mixing cone

This is the most difficult cone to get right as both ends plus the OD plus the overflow gap have all to be managed. To get the ends right use a reamer made either with a very tight tolerance which will do the job with least bother or with not more than 0.5° angle error which can be corrected for as will be explained. If all the checking to be described seems tedious, then remember that it only takes a fraction of the time already spent on the reamer.

Turning

The cone has to be a light press fit in the body which means the diameter has to be very carefully turned to size. The tolerance in diameter for this cone is much more critical than for the others as it must be resistant to forces within the injector and it is not clamped by the rims as they are. At the same time it cannot be subjected to a heavy pressing force as it could be damaged. For a cone of 0.25 in diameter, the internal force trying to move the cone will be less than 1 lb wt, and this suggests that a finger force of about 5 lb wt to insert the cone would provide a large safety margin. A dead smooth turned surface is more difficult to fit than one with a trace of turning marks as these can crush to enable the metal to accommodate to the bore. If the cone is finished and is then found to be *just* too loose, then a very light tinning with solder or knurling by rolling it on a hard surface with a round or triangular file might effect a cure. Or a set screw or two will hold it.

Use brass rod and secure it in the lathe chuck. Start by squaring off the end with emphasis on a clean centre free of pips or blemish and then turn enough length for the cone plus extra for parting off. Fitting a spring to overcome lathe backlash as explained later makes turning to close limits a lot easier.

When close to the finished size use a smooth file to clean the edge and to make just a whisper of a chamfer so that the injector body steam end can be tried for fit. A firm hand push fit is about right but it must feel as though the cone is securely held. An easy fit will move under steam, but if you don't feel like starting from scratch try tinning with solder and re-turn it to size. Knurling is more appropriate if it comes loose in service, for example if the cone has been removed and is found to have too loose a fit when replacing it.

Another way of securing a cone that is just too loose is to use locking screws through the body.

Drilling

Make an accurate centre using a pointed tool, sharper than the usual centre drill, in the tail stock chuck with the work revolving. This will give the best start to the drill bit which should if possible be the exact throat size and properly ground. If the two lips of the drill bit are not equal in size or angle then the hole is going to be oversize. If necessary, to avoid the oversize problem start with a smaller drill bit which, even if not ground quite right, will make a hole that will be truly centred and can be enlarged to the correct size. The proper size drill bit will then tend to follow the hole edges so that any lip inequality is less important.

Drill to a depth just a bit more than the overall length of the cone to allow for the drill point and to ensure full diameter for the whole length. If the drill is smaller than the exact size, the throat will have to be finished to size later with a needle reamer made as already described.

When drilling it will be necessary to pull back the drill bit frequently to clear the swarf; the drill will tell you with a painful squeal when the flutes are jammed full. Forcing the drill when that happens should be avoided. Super high RPM are helpful but not essential as 800 RPM does a good job. The actual drilling time is quite brief, less than the time taken up with the repeated need to clear the swarf.

If the drill is just under the correct size then a pointed hand held needle reamer made as explained above should now be used. It is not necessary to go deeper than about two throat diameters as this end will be used for the throat where the centring is most important and the remainder will be reamed larger anyway. Mark this outer end with a marker pen or a scratch to identify it.

Cut or part off and trim the freshly cut end for correct length. Remove any edge burrs.

Reaming

Before reaming starts make ID gauges, one at ID - 5 thou and one at ID -1 thou. These can conveniently be at either end of one piece of metal but mark them with for example, a long black mark for -5 and a short mark for -1 to avoid confusion. If not given, the ID will have to be worked out as shown earlier under "Calculations".

Insert the tapered throat gauge into the throat hole and mark the position of the throat diameter on the gauge. Also make a mark spaced from the throat mark by the cone length **L** minus any specified throat length **tl**. The accuracy of this is important for checking reaming depth. Also make a note of how far the point of the gauge can poke into the throat hole although this

probably will be done again later.

If the throat length **tl**, is unspecified or apparently zero then make it a minimum of 20 thou.

Next put the reamer point in the throat hole and measure out the same length **L -tl** and make a mark for using as a guide to the absolute reaming limit. Also make a note of how far the reamer enters the throat as when the reaming has reached the limit, the amount the reamer sticks out of the throat must be the throat length less than the amount it entered the throat. With care, this is almost as good as a proper gauge.

Set a micrometer or vernier etc to the cone **Id** as given or calculated and try this on the reamer. If this ID width is at a smaller width than the stop mark already made then this mark will need to be moved inwards to the ID width, otherwise the cone input will be reamed too large. This condition is found with a +ve reamer angle error. If the reamer angle error is -ve do not move the mark outwards or the throat will be enlarged.

Mount the cone in the chuck for reaming with the marked throat end INWARDS.

Ream carefully until about 50 thou from the limit mark and then CHECK with BOTH the ID and throat gauges starting with the -5 thou ID gauge for convenience . This gauge will be the first to indicate that the limit is near if the reamer has a +ve angle error. When this clicks in there may be only 20 thou or so of reaming still to do but this should not be done before a throat gauge check.

With hand held reamers, removing the cone from the chuck for checking is no problem, but for chuck held reamers the cone will have to be replaced **exactly** as it was to maintain the axis and the centre.

If the reamer angle error is -ve then the throat gauge will be the one to show that the reaming to depth is finished when the mark on the gauge at **L-tl** from the throat mark is just entering the reamed input.

Another very good way of using the throat gauge, for the mixing cone only, and the reamer can with care also be used in this way, is to remove the cone from the chuck, insert the gauge from the reamed end until the gauge is limited by the throat and measure the amount the point of the gauge sticks out of the throat end. Then insert the gauge from outside into the throat end and measure how far the point pokes in.

Pokes in - sticks out = the actual throat length.

At the first measurement there may be 50 thou or more excess over the specified or chosen throat length and of course this excess shows how much more depth of reaming is needed. But only if the cone **Id** is not reached first.

The reaming and checking is continued until **either** the throat limit **or** the ID limit is reached. The ID is correct when the -1 thou gauge clicks in about 6 thou to show that the reamer is finished with. The click in depth at -1 thou is theoretically only 6.4 thou for the usual 9° angle. (1/Tan A).

Watch the reaming carefully as the last few thou needs careful control of the pressure. This pressure must only be axial with no bias up or down or side ways.

It may be as well not to push your luck by trying for zero throat length even if this is required by the design as it is too easy to enlarge the throat. Stopping when the throat length is between 20 thou minimum and a maximum equal to the throat diameter will do no harm. The input diameter can be adjusted if needed as shown later.

Finally don't get carried away with the throat checking and forget the ID check or vice versa!

There are now three possibilities, the best of which is that the throat size and length and the input ID are all correct.

If the ID is correct but the throat is a too long (about 30 thou is caused by a $+1/2°$ error in reamer angle) then use another reamer such as a 6° one often specified for the output cone to get the throat length within limits. Any angle that is 6° or more and is at least 0.5° less than the one already used will do. This correction is a bit easier than the next to be described.

If the throat is right but the ID is under sized due to the reamer angle having a -ve error then use the technique described next. This could be used to correct for reamer thickness which gives an effective -ve angle error. Even with $-1/2°$ error the ID should not be more than 9 thou under size per inch of cone length so that there will typically be no more than 2.5 to 3 thou to scrape off.

To enlarge the ID continue reaming **with the reamer withdrawn by about 15 to 20 thou** from contact with the throat, lifting the slightly withdrawn reamer **without any tilting** so that it cuts at an effectively larger angle, and stopping when the -1 thou gauge just clicks in as described, indicating the correct size has been reached. The slight withdrawal and lifting without any tilting, which could otherwise use the point of the reamer as a fulcrum, is to avoid enlarging the throat area. All the cutting pressure is at the cone input end.

A reamer lift at the entrance of 25 thou or less will probably be enough for correction.

This action is not feasible with a reamer held in the tailstock and this will have to be removed and hand held "face up" in the same way as the hacksaw variety for this correcting action. Of course a knife type scraper such as described earlier could be used but remember that it is not just the entrance that is important so much as the diameter where the steam cone nozzle penetration forms the annulus.

If the reaming has gone too far so that the ID is too large, then the pressure range will have been raised so that the 100 psi behaviour for example may occur at 115 psi and the 60 psi action may now be at 75 psi and so on. Increasing the steam cone nozzle OD by the amount the mixing cone ID is in excess could compensate.

Finish off the input either by light burnishing with a smooth rod such as a drill shank or, if in the spec, first round off the entrance using a hand tool. A nominal 10 thou wide scrape at 45° is normally enough to break the edge before this is burnished. Note: before any rounding, make a note of the actual input diameter as this may be slightly different from the spec and the steam cone nozzle OD can be altered to compensate for a small error.

The throat, where the water velocity is maximum, should be polished with a pointed bamboo stick. These sticks are sold in supermarkets for barbecues and so on and are easily shaped on the grinder.

The overflow gap

In the example, this gap is made using cutting and filing as described at the end of this section. The more usual method is to use two separate sections and the example can be made in this way if desired.

Forming the overflow gap needs straight forward but careful lathe work, but before starting note the exact overall length **OL** of the cone and after finishing note the exact length of the output portion, L2. OL - L2 will be the length of either a collar to be used on the press tool when pressing in the input part or an extension piece for pressing in the output part. The collar or extension length tolerance is arranged so that the gap may be up to 1 thou wider than spec, as if it is narrower, the jet of water could catch the edge of the output portion. That is the reason why that edge is sometimes specified to be rounded.

There is usually an outer broad channel on the gap often specified to be turned first with a round nosed tool. This wider exit assists the escape of the fluids at start up. The depth of this channel must leave enough metal around the output section entrance to withstand pressing pressure and must also not intrude on the bore of the input section. The depth of the channel, if it is not given, can be found as follows.

A linear decrease in internal diameter from the cone **Id** to the throat is assumed. Then by proportion, the diameters of the bore at the gap limits can be worked out. Add a rim width to the output end of the gap that will withstand the insertion pressure and this will give the possible channel depth.

Example OD 250, OL 600, tl 40, T 51.2, Id 139, Gap at 205 to 272. Taper length OL - tl = 560.

Theoretical internal diameters at the gap are 139 - (139-51.2)

x 205/360 and 139 - (139 - 51.2) x 272/360 which work out at 107 and 96 thou.

For a rim of 20 thou on the output portion, the channel depth to be cut will be (250 - 96)/2 - 20 = 57 thou. The other rim width will be (250 - 107)/2 - 57 or 14.5 thou which is adequate as it is not subject to any pressure.

It will be found better to cut the channel on the two parts of the cone after separation, as it is easier to monitor the progress. This channel is never especially critical.

To cut the actual gap it is best to use a parting tool of the specified width than to do it in stages. Mount the cone with the throat end in the chuck and if your tool is too narrow then at least delineate the actual edges of the gap. The input section is parted off first as the bore of its' output is bigger. Then move the tool if necessary and trim off at the input to the output section. The inside edge of this must be de-burred and may also have to be slightly rounded if specified. Use a hand tool for the rounding and burnish to polish it. A 10 thou wide scrape at 45° off the edge finished by burnishing is usually enough rounding.

The input section bore must also be deburred where it was parted off. This can be done with a smooth drill shank or with a bamboo stick as used for polishing the throat.

If not already done, cut the channel described.

Measure **L2** the length of the output part. This size is needed to work out OL - L2 before finishing the pressing collar or press tool extension.

Pressing in the cone from the steam end

Collar method. The press tool has to have an easy fit in the body bore and with the OL - L2 collar against its end stop must have an inside length exactly the internal pressed depth specified for the cone. Its business end must be dead square and smooth. The output section of the cone is pressed in first without the collar, followed by the input section with the collar in place. It is better for the gap to be **slightly** too big than too small to avoid the possibility of an effective step down in diameter which will interfere with the jet and for that reason the collar tolerance is +0, -1 thou.

Extension method. The press tool for this has an inside length equal to the depth of the mixing cone from the steam end and for the first pressing of the output part, has an extension piece of length equal to OL-L2, with a tolerance of +1, -0 thou to keep the gap width slightly too big if not correct.

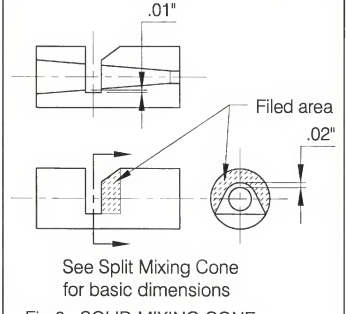
If a guide with a bore that will take an easy hand press of the cones is used for starting the press, tilting of the cone parts is unlikely to happen. If the output end of the injector body is protected from damage by a piece of car inner tube or a rimmed plug similar to the press tool or a nut screwed on the end, a vice may be used for pressing. The lathe can also be adapted. But whatever tool is used, everything must be in line before the pressing starts. As mentioned above, a press fit that needs more than about 5 lb wt pressing pressure is not necessary. Start the pressing without any extension piece to reduce the risk of tilting.

The central overflow gap which is set by the collar or extension length should now be as correct as it was made. It may be left just a trifle too large if anything but it must certainly never be too short or the edge of the output section can intrude on the flow of fluid.

The gap is usually accessible through the ball seat in the turret. With care to avoid either damage to the seat or moving the output part of the cone which should have a back stop for this, an easy fit brass spacer as thick as the gap width, can be used as a pressing limiter to make sure the gap is right.

Single piece mixing cone

(See **Figure 8**) In most cases, including the example, the split mixing cone can be replaced with an equivalent, which has the overflow gap only partly cut through so that the bottom part of the cone below the bore is solid from end to end. The gap may be cut in the lathe if the cone can be assembled in an off axis collet. About 600 thou offset is suitable, and the cutting depth is complete when the cone bore plus about 10 thou has been cut through. This method maintains the spacing relationship, and of course any overflow exits only through the top in either case. This type has some of the machining replaced by non-critical filing to make the expansion channel and to make that job easier the cone is gripped in some form of chuck, such as for example, a spare chuck from a wheel brace. If the lathe chuck is used, it is kinder to protect this from damage. A narrow flat file with one face and one edge ground smooth so that it is slim enough to fit in the gap is a useful tool for this work. The shaded area in Figure 8 shows the filing and the careful part is to file close to the bore and avoid filing where you shouldn't. The gap expansion to facilitate the escape of fluids can be confined to the output side of the gap and the turret is put slightly more forward than usual. The press tool is made equal to the mixing cone depth as for the extension method. Whether this technique or the more conventional split cone variety is used is a matter of individual choice for the maker.



See Split Mixing Cone for basic dimensions

Fig 8 SOLID MIXING CONE

Very occasionally injector action is improved, usually only with warm input water, with a bell mouthed entrance to the output section of the cone, the main purpose of this shaping being to break the edge. If the "one piece" format is adopted, find a drill that will clear the exit from the input section of the cone but is bigger than the output section entrance. Grind the point to 90 instead of the usual 120 degrees then stone the possible cutting edges of the side flutes to ensure they won't cut. With the cone revolving in the lathe and the drill hand held in a pin chuck or a wooden handle it can be used with a **light** touch to break the edge, forming a short angled entrance to the output section which will do the job. This edge and the internals of solid and split mixing cones are best burnished and polished with shaped bamboo sticks.

Always take care when pressing in cones to avoid damage to the reaming. If the injector body was drilled or bored from the steam end it will probably be found that this end has just a trifle larger bore than the rest of the body and this helps considerably in getting the pressing operation started. Any lead that can give a start, even if only a thou or so chamfer at the edge of the cone, will help.

One more reminder to note the mixing cone **Id** before assembly, taking any rounding into account, as it is difficult to do afterwards and the steam cone nozzle diameter can be modified if necessary to take up small errors.

(To be continued ... in the final instalment we will be making the steam cone, the delivery cone, looking at some more calculations and finally making and testing a 60 oz per minute injector.)

Garratt Gossip

with John Cummings

Well, I hope that you all have enjoyed *AME* Issue 100, especially Peter Wardle's article on the 7¼" Garratts at Weston Park. I am only jealous that he could not have tried for an invitation in 2000 while I was visiting him. I had thought that the photo of John May's AD60 running will give all those AD60 builders the urge to get stuck into finishing their locos.

Talking about AD60, I have a request, could any of our American readers inform me of where the N.S.W.G.R. AD60 Garratt built by Lyle James is. Has it been finished and is it steaming?

5" gauge Freelance Garratts

Last October I received a phone call from Shawki Shlemon to tell me that he had successfully steamed his freelance Garratt (0-4-0+0-4-0) and asked would I like to see it ? Now readers of *Garratt Gossip* would have seen Shawki's drawing that was published in issue No 94 showing his idea of a high pressure flexible joint. Well, he has incorporated this design along with Peter Wardle's cylinder drain cocks, which all work successfully. As Shawki said, "It is not a model of of any particular Garratt" but he set out to show that you can build a small Garratt that will work successfully. What follows are his words.

Started with Tasmanian " K " class idea and finished up with this freelance. It consists of two 3½" gauge *Juliets* widened to 5" gauge. It has a wide firebox boiler with 2 superheater elements, high pressure steam pipe joints as per *AME* No 94, drain cocks as per *AME* No 85.

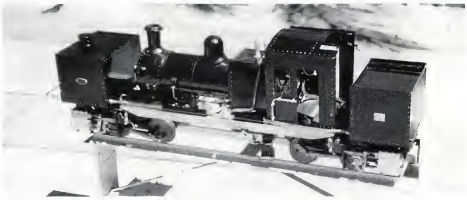
Dimensions are cylinders — bore 1 1/16" x stroke 2⅛", wheels 3¾" dia., valve gear is Baker, length of loco 3' 4", width 8½".

Shawki tells me that on the day he steamed up and ran it at the Western Districts track at Fairfield, Neil Matherson's loco failed so Shawki pushed Neil and his loco back to the station and did this little Garratt work. So it goes to show what a small Garratt can do.

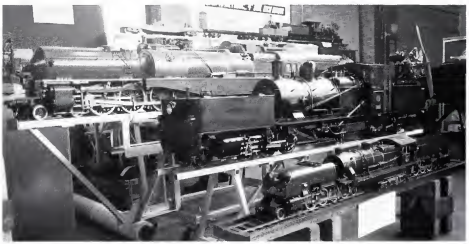
Robert Wooley e-mailed in early November to say that his freelance Garratt *Pegasus* has been steamed up and ran successfully. A photo of it in action appeared in the last issue of *AME*.

Garratts in South Australia

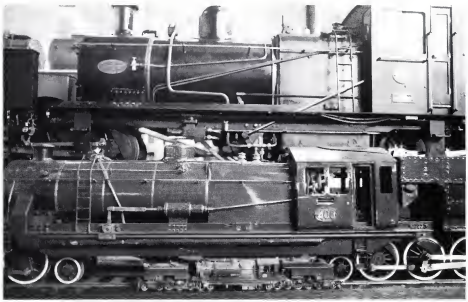
Sometime early last year I was given a copy of the Adelaide Miniature Steam Railway Society,s magazine and it has a centre fold (behave yourselves) of 3 Garratts. After a lot of ringing around I finally located the owner of the negatives, John Lyas of Adlaide, who kindly loaned them to me. If you look closely at the photos below you will see that there are 4 Garratts. Starting from the front No1 (builder unknown, can any one tell who the builder was.) No 2 Bob Brown's 2½" gauge South Aust. Railways 400 class Garratt. No 3 Keith Bradford's 5" gauge Fyansford Garratt. No 4 Bob Brown's 5" gauge freelance Garratt.



The Tasmanian K class origins are evident in Shawki Shlemon's freelance Garratt



The four Garratts referred to in the text. The view below shows the small one in front a bit better. This little one is the one whose builder is unknown. Can you help?



South African NGG16 in 5"

Warren Williams of the Hornsby Model Engineers Society rang in November to ask had I seen the Sydney Live Steam Loco Society's club magazine, because in it is a photo of Trevor Collett and the Garratt he is building, (with some help from son, Rolf) so I rang Trevor to beg for a photo.

Trevor says the last batch of the South African Railways NGG16 was built in South Africa in 1969. The prototype is 24" gauge and 2-6-2+2-6-2 and SAR were quite prepared to supply complete sets of drawings (about 240). I obtained 106 high quality dye-line copies.

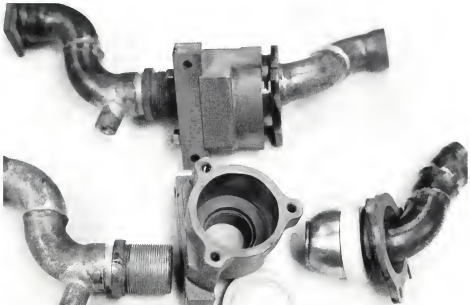
The model is approximately the same loading gauge as *Mountaineer*. Overall length 10'3", cylinder bore is 2½", boiler diameter 12" and the grate is 11½" x 11½". There are 41 tubes at ⅝" diameter, 6 at 1¼" dia. and 6 superheating elements which extend into the firebox. The driving wheels are 6⅞" dia. and bearings for all axleboxes and valve gear contain needle rollers or races, coupling rods are done in bronze. Water tanks and coal space are made from ⅛" (3mm) plate by pressing and brazing. Trevor made his own patterns and core boxes for the cylinders axle boxes and wheels, allowing for steel tyres. Suspension is completely compensated. As in *Mountaineer* piston and steam chest rings were made from good quality iron using the recipe in *So You Want to Build a Steam Locomotive*.

Both engines have run for several hours on air and oil and seem to enjoy it. The original intention was to use flexible hoses for steam delivery and exhaust through the main pivots, but fairly close copies of the prototype were made using steel, bronze and teflon.One useless statistic — a poor steam (or water) molecule has to travel from the dome through the regulator and the superheater plumbing to the rear cylinders, work and return via the the plumbing to the blast nozzle and top of the chimney, a distance in excess of 26 feet.

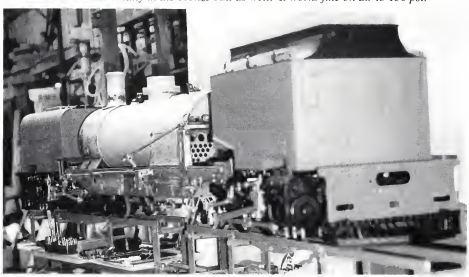
Other Garratts on the go

November was an intresting month besides Warren Williams phone call, I received two e-mails, one from Brendan Vosper who wants to build a 7¼" gauge Garratt based on the Tasmanian "K" but a simple design. I suggested that he takes Peter Wardle's British Industrial Garratt which is 2½" gauge multiply it x 3 which makes it 7½" but regauge the frame etc. for 7¼". The other e-mail came from Richard Stuart of Perth. Apparently he and 3 others are building three 7¼" Garratts of 2-4-0 + 0-4-2 wheel arrangement and one-15" gauge of the same wheel arrangement. He has offered to write an article for us along with photos for the next *Garratt Gossip*.

John Cummings is about to move house so until further notice you can email him via the AME office



Trevor's NGG26 and here are 2 exhaust ball joints — bronze balls, Teflon caulking! The short S-bend slides axially in the bronze ball as well. It works fine on air to 150 psi.



Most of the components so far — it is starting to look like a Garratt

Temporary assembly to check clearance. The curved coal space on top of the tank is removable to provide a seat for the driver to sit.

Welding for Beginners

Part 2 — Supplementary notes

By Peter Dawes

Drawing for publication by Dave Adams

Synopsis

Recapping, the main message from Part 1 (*AME* issue 101) was for beginners to use one of the small very low cost transformer welders that are becoming widely available, but to use an 'electronic' helmet, which unfortunately is much more expensive. Incidentally, I understand that Einhell has been absorbed by GMC but there are now a number of other very similar brands names on what is the same welder, and all at about the same price, so for the purposes of these articles they can be treated the same.

This time I will introduce a relatively new technology. This is the INVERTER welder. But first I will plug a few gaps in that first article.

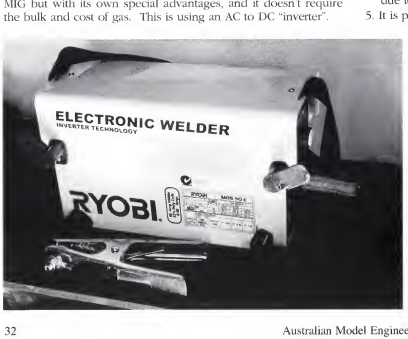
For those who want more detailed information on welding technique generally, I suggest reading the articles in *Model Engineers Workshop* issues number 3, 12, 71, 79 by Bill McLean and Trevor Marlow. You might be able to borrow these from a colleague. The first three deal with stick and MIG and the last one with TIG. Number 71 also includes a small comment on stainless steel and aluminium welding. The welding machine you buy will usually have some basic instructions.

Be aware that TIG requires considerable training and the overheads make it expensive unless one is doing a lot of welding. So in my opinion it is much better to give your occasional TIG jobs to the experts. This runs counter the comments in *MEW* #79.

Something I should have mentioned in the first part of this article is that clothing needs to be closely woven. It should have long sleeves with a full collar. Thin cotton shirts are not sufficiently opaque to the UV to afford adequate protection. Heavy cotton work shirts with long sleeves are ideal. I said that gloves were not essential for quick jobs and that remains true, but they ARE essential if welding continuously for a few hours. Thin leather 'driving' or 'rigger's' gloves are the best because you don't lose the sense of touch. I obtained a pair of pigskin rigger's gloves for $8 from a work-clothes supplier.

The inverter

If users want to go up-market of the simple, very cheap, but perfectly workable system I described in *AME* issue #101, and are prepared to pay more, there is another alternative. A relatively new technology is available for the same approximate cost as MIG but with its own special advantages, and it doesn't require the bulk and cost of gas. This is using an AC to DC "inverter".



The inverter converts the mains power to lower voltage DC electronically instead of using a big iron transformer, and the welding current is also controlled electronically rather than with an iron choke.

This inverter is even smaller and lighter than the welder pictured in issue #101. It weighs in at about 4 to 6kg depending on amperage and the particular brand, and is about 300 x 200 x 100mm (approximately) in size. You carry it with a strap over your shoulder trailing only a 10A or 15A mains cord behind instead of two heavy welding cables plus the mains cable. It must be the answer to a prayer for working on the frame of a large steel building or on a bridge, although for those jobs you might need a larger type running on 3-phase rather than the one I am concentrating on here, which is the smallest version and obviously the cheapest.

Most of these inverters can run TIG with an optional electrode holder. The electronics behind the two systems is more or less the same. Now MIG and TIG are undoubtedly superior but the cost of renting the gas cylinder is a real killer and this is why what makes them unsuitable for casual users.

Advantages of inverter welders:

1. Very small size and light weight. In fact, it is easily the smallest and lightest machine available for arc welding.
2. Welding current is set with a small radio type knob (from 10-85A for smaller models) instead of having to position and lock a heavy steel choke. But a reduced duty cycle may apply at heavy currents depending on the particular machine. This duty cycle isn't necessarily a serious problem because so far, with my admittedly limited experience with the Ryobi I've never had the warning LED light up.
3. The arc is DC and this confers certain advantages. It is relatively 'non-stick' and easy striking. But the rod CAN stick if you run it without sufficient current. With more experience sticking becomes less of a problem. If it sticks for longer than 3 seconds I let the rod go from the holder and break it free with pliers. I have never tried to see how long it will sustain a short circuit without overheating, as I'm not prepared to risk damage. So do not be put off by the 25% duty cycle.
4. The welding seems to proceed much more smoothly than with the conventional arc welder, with less spatter. This may be due to the high frequency used. It is a personal impression.
5. It is possible to weld down to 1mm thick steel with care and experience, whereas the conventional welder can only get down to 2mm easily or 1.6 with difficulty. In this respect it is like MIG welding although the latter has to be considered the best for thin work. At the other end of the scale, the small models (85Amps) cannot handle rods much larger than 2.5mm although I have on occasion run 3mm rods without any trouble, so that means work up to about 6mm thick, and the duty cycle will limit the amount of time you can run the welder at that current.
6. The cost of the welder is similar or slightly lower than MIG but as it doesn't require gas, the overall cost is much lower.
7. I understand that it is not difficult to adapt these welders to gas, either for MIG or TIG but I have no personal experience. The attachments for gas are an extra cost.
8. The smaller capacity versions just plug into a standard power socket with a 15A fuse. Big versions require three phase power but you are talking big money then.

Disadvantages:

A. Cost is really the only disadvantage. The cheapest I came across was the Ryobi MOS90E at $450 (later raised to $485), from Bunnings. This machine is rated at 85A at 25% duty cycle. The package includes a very primitive hand-held shield rather than a helmet, a simple but adequate chipping hammer, cables and one (yes, just one) 1.6mm rod (I don't know where to get any more of them). The shield is only good for a second person watching the arc. Unless you are already an expert welder, use the electronic helmet. That electronic helmet is NON-negotiable for beginners.

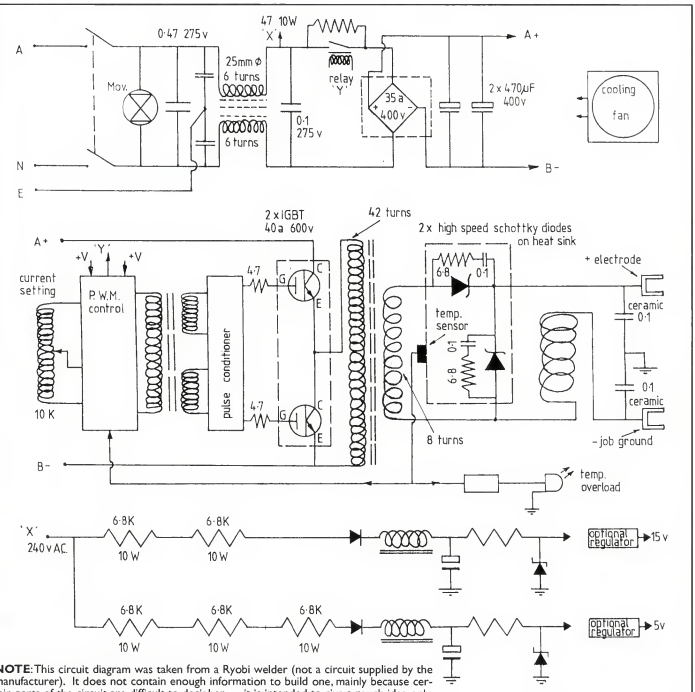
A similar one is the Telwin welder carried by Hardware House Stores (a stable-mate of Bunnings). The smallest of these cost $485 and a "turbo" model with a fan was extra. It is much the same size and has the same capacity as the Ryobi. I am sure you could add the fan yourself much more cheaply provided you can get one from a scrapped computer or photocopying machine.

A slightly larger Ryobi (the MOS 140E) is rated at 130A on 35% duty cycle. Other machines range to over $1200. Some, such as the Eutectic and Lincoln at BOC are specified to 100% duty cycle. However you pay a lot for that and it is certainly not necessary for our work.

B. Semiconductors are more "fragile" electrically than big iron cored transformers so another disadvantage is that you must treat them with more care. You generally get no warning of a failure. Large spikes coming down the mains are a common cause of failure in all transistor-based devices and this welder will be no exception. Repairs to the electronics are beyond the amateur's capability so the machine has to go back to the manufacturer and that can take weeks (not that you can rewind a burnt out transformer either). However if it comes to the crunch, a transistor is easier to replace than a transformer winding! The manufacturer probably would just replace the single circuit board complete. The circuit shown here is typical of a machine like the Ryobi MOS90E.

Pull the plug!

While on this subject, I recommend that users always pull the plug on all their valuable electronic equipment whenever there



NOTE: This circuit diagram was taken from a Ryobi welder (not a circuit supplied by the manufacturer). It does not contain enough information to build one, mainly because certain parts of the circuit are difficult to decipher — it is intended to give a rough idea only.

are electrical storms about or when they leave the workshop for any length of time. This applies to computers, TV sets, hi-fi amplifiers, and all computerized appliances in the kitchen and laundry.

That should not be taken as a serious flaw, but it's a precaution worth taking. I always pull the plug on my computer and my variable frequency motor controllers in the workshop during electrical storms. It's worth the trouble because these are very expensive items to replace. No supplier I spoke to would admit to a problem with semiconductors failing in these welders - for what that's worth.

A friend once lost just about every electrical device in his house due to a lightning strike on the mains close by. It even burnt out the motor in the refrigerator. Just turning things off at the switch is not sufficient. That is because a big strike easily jumps the switch contacts.

Incidentally, one word of caution: One supplier warned against using an inverter welder on a motor alternator supply, possibly because of the risk of badly controlled voltage causing damage. In another case, it was recommended to use an alternator of at least 5.5kW.

Principle of the inverter

Broadly speaking, the 230VAC mains is filtered, rectified, and then smoothed with a couple of large high voltage electrolytic capacitors. The LC filter at the input prevents switching transients getting in or out (to comply with the new EMC regulations). A varistor clips any large voltage spikes from the mains. The varistor might sacrifice itself in the process but at a couple of dollars it is cheaper to replace than the whole circuit board.

The resulting 340V DC is then chopped by one or two IGBTs (Insulated Gate Bipolar Transistors) at a much higher frequency. The older machines probably ran at around 1kHz. The small Ryobi works at about 55KHz.

This new AC is then transformed to the lower voltage and higher current required for welding by means of a relatively small ferrite transformer. The transformation also performs the vitally necessary isolation of the output from the mains input. This AC at a lower voltage and higher current is now rectified again by special fast-recovery, high-current diodes. Finally an air cored inductor on the output partially smoothes out the current flow to the electrodes.

The Ryobi inverter open circuit voltage is about 65 VDC as measured with an ordinary DVM, (an RMS meter wasn't available). The waveform has a big influence on the voltage readings so the exact peak value cannot be deduced from those readings. I have not studied the waveform with an oscilloscope but I expect that it would approximate a square wave.

The GMC/Einhell welder open circuit voltage is about 45VAC. The arc voltage swings wildly but probably averages around 10 volts +/- 5volts.

Therefore, this inverter is basically a DC welder with the DC chopped at very high frequency into (nominally) square waves with a variable mark-space ratio that determines the current. The open circuit voltage of 65 volts gives easy arc striking.

Temperature sensors in the transformer and in the heatsink of the IGBTs and perhaps elsewhere, can shut down the power if they detect excessive temperature and the Ryobi has a small yellow LED on the panel that lights up if the temperature on the output rectifier heatsinks should become excessive.

The light weight of the device is only made possible because of the high frequency chopping. Otherwise we would require the same big iron transformer as before. Instead of a magnetic choke, control of welding current is by a low voltage circuit operating on the gate terminals of the IGBTs. The IGBTs are turned on and off at high speed to govern the average amount of current let through.

High frequency is also a desirable feature for welding some metals and it probably makes the arc more stable. Certain types of job require AC but this welder does not provide for it. In theory it should be easy to obtain AC just by by-passing the output rectifiers.

The key component of all inverters irrespective of whether they are for welding or for motor control, is this IGBT and because it is a relatively new type of semiconductor, and still somewhat expensive, it hasn't been a practical proposition to make welders this way until recently. The IGBT is a cross between the traditional junction transistor and the metal oxide insulated field effect transistor (MOSFET). It has the best features of both, namely low 'on' resistance when conducting, and a very high input resistance on the "gate" (the input terminal), combined with the ability to operate at high switching speeds. Even now, the high current ultra fast switching IGBT is easily the most expensive single item in the welder. In one-off quantities they can cost over $50 each and there are two in the Ryobi. The special fast recovery high current diodes required to rectify high frequencies are also expensive.

Inverter welders generally include a small computer-type fan to assist in cooling the semiconductors, which are particularly sensitive to high temperatures. This fan might run on 12VDC or directly on 240VAC.

Safety features

A special feature of one brand I came across is a safety feature called "VRD" (voltage reduction device) which cuts the voltage across the electrodes until they sense a low resistance between them. So the manufacturer is claiming a low open circuit voltage until there is metal-to-metal contact of welding rod to work. Another machine claims a maximum open circuit voltage of 92V and a minimum ON voltage of 12V.

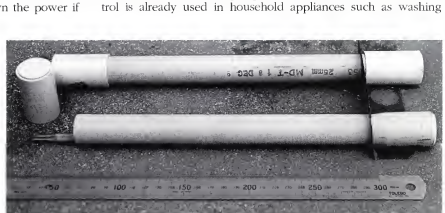
The Ryobi 90E has an open circuit voltage of only about 65 'average' volts DC. So it should not pose a serious electrocution hazard. Nevertheless the instructions warn against touching the active lead. So thin leather gloves such as driving gloves would be a way to kill two birds with one stone so to speak, by protecting the hands against UV at the same time as providing insulation. The job ground is the negative lead on the Ryobi, but some jobs require reversal of the polarity.

Conclusions

I am convinced in the short time I have used an inverter, that they will be the way of the future for arc welding - with or without gas. The cost of the semiconductors is the main factor holding them back right now. There are already quite a few manufacturers making the IGBTs, and many people can make the high precision, complex, double-sided printed circuit boards for the tiny surface-mount components that are the building blocks for all automated electronic manufacturing.

It is a catch-22 situation of course. The cost will not come down until the volume of production goes up, and the volume is not going to go up until the cost comes down.

But eventually it is going to be intrinsically much cheaper to build an inverter welder than a heavy iron one with its big copper coils. Hi-tech know-how is a factor influencing the cost, but many of the electronic techniques used here are well established in other fields. For example, pulse width modulation (PWM) control is already used in household appliances such as washing



machines (e.g. the Fisher and Paykel SmartDrive) although there are enough subtle differences, to make the welder a special variant.

I had expected the price of variable frequency motor controllers to come down in the last five years but so far this hasn't happened. The problem is the Australian dollar. Our dollar has been falling slowly and steadily against the $US over many years, so much so that a decade ago it was worth US$1.5. Now it is worth about half a $US. There is every reason to assume that this process will continue, on account of our chronic intractable current account deficit (but that is another story). So it means there is not much point in waiting. It seems to be boiling down to a race downwards between the Australian dollar and the technology.

Eventually though, you will just hang up your welder on a hook or put it on a shelf with other hand tools when you have finished using it.

So to summarise, the inverter welder is not a "must have" at present because of cost. The little GMC or one of its clones is perfectly adequate for loco building, for making rails and for use in the home shop. But if you are planning a lot of heavy permanent way with bridges and buildings, then you might think seriously about one of these and perhaps the larger model. If you want to work on thin steel the inverter used with 1.6mm rods is definitely superior to all but gas assisted welding. That still takes skill so builders might still find silver soldering the easier alternative, even though it takes longer to set up and requires a lot of job preparation.

If you happen to opt for the Ryobi then there are a couple of easy and worthwhile improvements you can make. Firstly, paint the rubber handle of the Positive cable red to save mixing them up each time you plug them in. Secondly, make some simple angle brackets from 1.6 x 20mm flat stock and attach them to the case of the welder to wind the cables round. They will fit under the existing screws on the sides. Make four for each side and they would probably be appropriate for other brands as well.

The third idea is make a pair of airtight containers out of 25mm plastic electrical conduit to hold rods, and attach them to the top of the case. Cut 2 lengths of conduit 260mm long (to suit 300mm rods). Proper caps are not available so glue a plug into one end of two 48mm long 'joining sleeves'. One of these is used to seal up one end of the tube permanently and the other becomes a push fit cap for the other end. The resulting length inside the tube is such that the ends of the rods should project about 15-20mm to make withdrawal easier. Make two aluminium brackets with holes spaced 80mm apart on centres. The holes should be a close fit on the tubes. Attach the brackets to the top of the inverter case with the existing screws. With the tubes along each side, the carrying strap fits comfortably between them. Keep 1.6 and 2mm rods in one and 2.5mm rods in the other.

Electronic helmets

Unfortunately their cost seems to have gone up since I first wrote. $200 will now only buy the electronic insert to go into an existing helmet. I would be happy to recommend this except for one small point; it only has one centrally located sensor. If the light from the arc is blocked for any reason, such as the operator's hand getting in the way, the glass will not switch, and that would not be acceptable. I do not have experience of these to be able to say if they are safe or not. Therefore I am not going to comment.

The cheapest "full helmet" electronic that I came across was the standard model Xelux at $250 + GST from Com-Pak in Orange. That doesn't mean there isn't a cheaper one. The Pro version costs $350 but includes a switch to control the degree of darkening for different applications. Both versions have dual sensors spaced 50mm apart and both can handle TIG, although only the Pro version can be used with oxy acetylene.

The full helmets from BOC start at $300. They have two sensors, one on each side of the glass about 100mm apart, so that if one should ever be obstructed the other will take over. I can report that I have never had a failure to switch of my "SpeedGlas" helmet from BOC.

Remember that if you are planning to go into TIG welding, the helmet must be one with a high sensitivity sensor because the TIG arc gives off less light.

Most helmets have built-in silicon solar cells to maintain the charge on the small battery that powers the electronics, and most helmets also incorporate "auto switch-off" after about 5 minutes of inactivity.

Finally I wish to report to readers that I have contacted an electronics magazine to ask if they will present an article on inverter welding and perhaps do a construction project.

It should be well within the capabilities of the amateur electronics buff to build one of these and the cost should be lower than that of commercial units because the parts should be generally available from suppliers such as Farnell and main street retailers. Inexperienced hobbyists probably should not tackle the construction because of the lethal voltages present in the circuit. There are a couple of special construction hurdles. The first is the high cost of the high-current, high speed IGBTs and rectifiers, and the second is the unusually large ferrite transformer that has to be wound with multiple strands of heavy wire.

I do not think that electronic helmets are a suitable subject for amateur construction, at least at present. That is because the welding 'glasses' (which are actually liquid crystal devices), must have very fast response times. The makers are unlikely to offer them separately only to compete with their own more expensive product line. So until a market starts up with suitable glasses from multiple sources, it's unlikely there would be any cost advantage.

So while I think that inverter welding offers the ultimate in portability, smoother welding, and the ability to work on thinner steel, cost is a serious deterrent. It depends very much on how important those properties are to you and what your budget is.

At the time of writing, 1A$ is about NZ$1.2, UK 36p, .58 Euros and 52cents US.

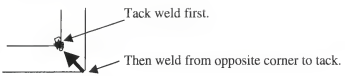
Postscript: The SuperCheap Auto store has just held a one-off 20%-off storewide sale and was selling the GMC/Einhell welder for $150. While the price of inverter welders is bound to fall I would not like to predict when. Computer prices have fallen steadily and dramatically, but engineering equipment has not.

A Few Notes on Arc Welding

by Alan Craggs

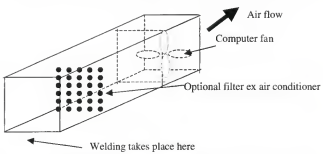
I would like to add to Peter Dawes' article *Low Cost Arc welding for Beginners* in issue 101.

1) welding is like with everything it requires practice. Start off on scrap pieces until you get the hang of it.
2) Weld only the surfaces you can grind up. This will be strong enough for most jobs
3) A small piece of copper (about 50mm square x 5mm thick) clamped on the underside of a thin joint will take the heat away and prevent burning through the job. The weld won't stick to the copper, which makes it great for filling up holes.
4) Tack weld the joint on the larger section then weld from the thinner to the thicker section as shown. This stops burning away the corner.



5) Once the flat butts are perfected try welding "T" or corner welds. Both pieces should be fused together at the same time with a nice profile as shown.

6) Install a smoke detector in the workshop. When it goes off it's time to quit welding.
7) A square computer fan (120mm square) mounted in a box 500mm long will draw welding fumes away from your face.



8) Magnetic clamps can cause problems to the acr condition and attract the electrode if welding too close to them.

Dog Spike Whistle/Bottle Opener

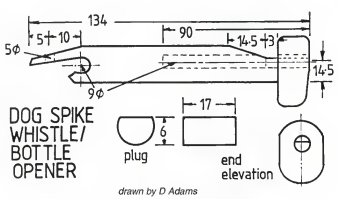
Railway spikes (dog spikes) were used to hold the rails to the sleepers.

The whistle was used by fettlers:-

- As a warning for when the "ganger" (boss) was coming
- To open their beer bottles
- To whistle to local friendly ladies at night for an evening chat.

This is fun to build and sounds like a steam whistle

Darryl Cleburne



drawn by D Adams

Keep it Simple

A series on using simple methods in the workshop with the beginner in mind

by Murray Lane

Photos and drawing by the author

2. Simple depth gauges

Here is a very simple but extremely useful device, which will be used much more than the traditional type of depth gauges. It is very easy to make, and very easy to use. You will find that it will be used more where, in the past, other more complicated methods were used. It can be used where other gauges are too large, or are too bulky to fit in the available space.

The secret of this little gadget is the spring loaded pin, which holds the depth pin place. This keeps the depth setting in place, which can then be measured easily away from the job. Sizes are not critical, and the measurements shown are for the ones I made. The depth shafts can be made to any length to suit.

Depth shaft 1

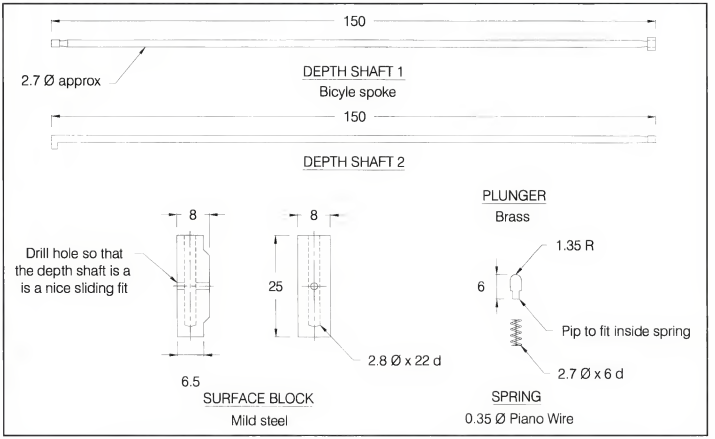
The most suitable material to make the depth shaft is a bicycle spoke. The local bicycle shop should have no trouble in supplying one. This material is strong and flexible and the only turning required is for the notches at either end. The square edge of the notches should be facing the respective ends and will prevent the shaft from coming out of the block accidentally. The shaft can be pulled out with a little force, but be careful not to allow the spring and plunger fall out if you do this. Machine the notches close to the chuck, as the shaft is thin and flexible, and will tend to move away from the tool. The head on the other end is a suitable little tube Loctited® to the end. This provides a grip on the shaft for adjustment. Put a small chamfer on the ends.

Depth shaft 2

This shaft is similar in size to number one. Instead of grooving both ends, bend one end at right angles. File the inside of the corner to remove the inside radius and the outside to make the hook a little thinner. Ensure that both sides of the hook are at 90 degrees to the shaft. The other end is grooved but the little head is not wanted, as the shaft will have to be inserted from this end. This depth shaft is used for measuring the distance to the sides of an internal groove inside a hole.

Surface block

The measurements illustrated are from my own units, which I have found to be the most suitable for the work carried out in general model engineering work. They are made from 8mm (5/16") square mild steel. Face off one end of the square in a four-jaw chuck. Make a centre pop in the other end offset 1.5mm from one side. Centre the centre pop in the four-jaw chuck with either of the centre finders I described in *AME* issue 96. Centre drill and then drill a 2.5mm hole 22mm deep. This is opened out to 2.8mm. Make a centre pop in the middle of the side nearest to the hole drilled. Mount in the chuck with 1mm sticking out from the jaws and centre as before. Centre drill and then drill through with a drill 0.2mm smaller than the depth shaft diameter. Take a thin cut off the face, this will ensure that the face of the block and the hole are at right angles to each other. Open out the hole until the depth shaft is an easy sliding fit in it. Rotate the block 180° in the chuck, and turn the other face down 1.5mm deep from the ends, with a tool set at 45°, until the face measures 20mm in diameter. This is an optional step, but it does make the gauge look a little more professional. To save changing the depth shafts in the head why not make two surface blocks.



Spring

A spring is required with an OD of 2.7mm diameter, and around 6mm long. This should be made of 20 swg gauge piano wire with 4 turns, and be an easy fit in the 2.8mm diameter hole. It may necessary to experiment. Ball point pens are a good source of small springs.

Plunger

The plunger is made of brass and should also be an easy fit in the hole. The pip in the end should be an easy fit inside the end of the spring.

Put a drop of oil into the hole and then insert the spring followed by the plunger. Press down with a small screwdriver, while inserting the small end of the depth gauge into the cross hole from the turned down side. The depth shaft should be a firm but an easily movable fit in the hole. In use pull the depth shaft up and lay the face of the surface block flat on the end of work piece. Push the depth shaft into the hole to measure or down onto an internal flange to be measured. Remove from the job and measure the amount the depth shaft sticks out from the surface block face. In the majority of jobs a ruler will be good

enough for this. The number two unit is inserted into the hole until the hook on the end slips into the groove. Pull the shaft up until it catches the near face, remove and measure the distance from the surface block to the inside of the hook. To measure the width of the groove insert the depth shaft until the hook slips into the groove. Now push the depth shaft in until the hook touches the far face of the grove. Remove and measure the distance. The width of the groove will be the difference in the two readings.

Well there we are, just about the simplest of tools, but you will be surprised the uses it will be put to.

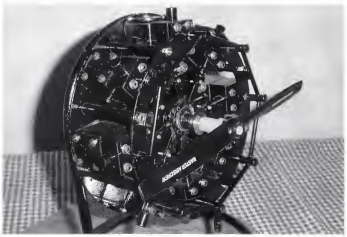
-A

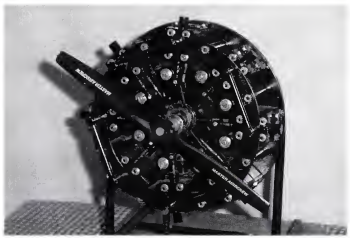
An 8-Cylinder Double-Acting Radial Engine

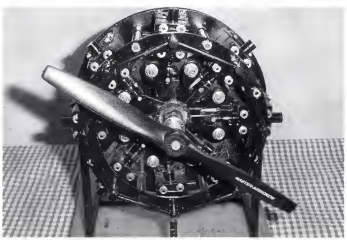
John Carnsew does not build the type of models most people go for. Remember his chap on a trike a few issues back in *Letter Box*? His latest model is an 8-cylinder double-acting radial engine, recently completed. This little motor is 6½" across with a stroke of ⅝" x ½" and has a 4" internal flywheel.

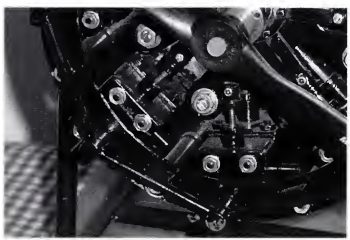
He reports that at this stage it runs very sweetly on air and all he needs now is some kind soul to design an appropriate boiler for it. Below are some digital images he sent in. I am hoping that eventually John can be persuaded to write a full article for us.

David Proctor









Club Roundup

compiled by David Proctor

Balcatta, WA

With the generous support of the City of Stirling, sufficient new palisade fencing has been supplied to replace the whole southern boundary fence, adjacent to the park. The old and now very tattered chain link fence on that side has long been an easy access point for vandals. The new club building continues to progress. The April run day was a bit dull weather-wise but was profitable enough to almost pay the expenses incurred with the new fencing. The club *Bloutfly* performed flawlessly with its new gas firing system made and fitted by Ernie Redford, primarily for the AMRA show.

Northern Districts Model Engineerng Soc
Location: *Vasto Place, Balcatta*
Public Running: *Last Sunday*
http://www4.tpg.com.au/users/jimclark

Blaxland, NSW

The deviation around the front of the pond has finally been opened to passenger traffic. It was used for the first time during February running day and proved most successful. Work is continuing on the signalling for this section in preparation for the NSW Interclub run in August. This almost doubles the available main line track to almost 600m (2000 ft).

The passenger carriages have all been repainted and look spic and span for the coming year. The canteen has received a long overdue refurbishment during the holiday period thanks mainly to our "greytops" ably led by Cole Hale and Alan Parkinson. This has given the ldies a modern working environment which is very pleasing to the eye.

Blue Mountains Railway Society Co-Op
Location: *Cnr of Graham and Haymet Srs, Blaxland (Wascoe Siding)*
Public Running: *1st Sunday, except Jan.*

Box Hill, Vic

Our Good Friday Appeal Children's Hospital Run raised $2,300. Usually this is around $3,000 but the day was fairly miserable and so we thank all those who helped and supported us.

A local secondary college is sending us a group of three students (14/15 years old) several times a year for a six week stint in community involvement. After a few teething problems the system is settling down resulting in benefits to both parties. Who knows we may be creating an embryonic beginnings of a future hobbyist.

The body panels of the D57 have been painted and its completion inches closer (apologies to Dylan Thomas).

Continuing problems exist with carriages particularly couplings and bogies. A policy of replacing worn out/damaged bogies with new bogies rather than keep repairing the former is being implemented to help overcome the problem.

We are asking fellow clubs for ideas for our 'social nights', i.e. the bit after the normal meeting. We will happily share our ideas with those who help us (PO Box 61, Box Hill Vic 3128 Ph. (03)98982671).

May I finish by saying the *Comment* on page 5 of the May-June *AME* should be framed and mounted in all readers' workshops because it truly puts into perspective what we are all about.

Box Hill Miniature Steam Railway Soc.
Location: *Cnr Elgar and Belmore Streets, Box Hill*
Public Running: *2nd & 4th Sun.(check)*

Bulla, Vic

The station progress has been a little slower than was hoped for. After changing brick layers there is now one wall of the ticket/kiosk area standing to almost window height level. The track leading to the station has been re-instated. Once the station is completed the whole track will need re ballasting in both directions.

The barbecue shelter area now boasts the three shelters to the upright pole stage, with the first almost ready for the concrete base. Next will be to cut the poles level and then the roofing. The shrubs around the perimeter fence in this area are all growing well and looking healthy.

3½"/5" track — the laying of the track is at a temporary halt while the construction of the station takes place. Rather than be idle, work has continued in the small carriage shed. Alf has machined up the point frogs which have turned out a top job. Two point sets have been completed and checked and they work beautifully. Both sets have been sleepered, thanks to a supply of treated pine. We are using the old level mechanisms, overhauled and painted; but with them being attached by bolts to the base instead of welded as previous. All are being rebuilt to a common standard so they can be unbolted and exchanged if servicing is needed.

Tullamarine Live Steam Society
Location: *15 Green Street, Bulla*
Public Running: *1st & 3rd Sundays*
www.netconnect.com.au/~tlss.

Bunbury, WA

A committee has been formed to make plans for the convention in 2004. A new track circuit has been decided to make it more interesting and taxing for locos and drivers. At the moment we have a dual gauge of 5" and 7¼" on the small inner loop and 7¼" on the larger outer loop, both passing through the station and a total length of approx 900 metres.

Under the new plan all main lines are to be 5" and 7¼" dual gauge. A new line will be taken off the inner loop by the carriage shed running parallel to and passing under the existing line, which while be raised on an embankment. The new line will bypass the station then return to the station on the existing loop. The new circuit will enable both platforms to be used to their full potential, and improve passenger transfer. A new 5" line is to be added inside the existing small loop for engines that have difficulty making long runs.

South West Model Engineers Association
Location: *Forrest Park, Bunbury*
Public Running: *3rd Sunday*

Burnaby, BC Canada

The directors have now passed our new safety system. Drivers are now required to be able to stop in the distance they can see, rather than half the distance, since we no longer have two-way track. No intoxicants (alcohol, etc) may be consumed on site during public running hours even if not driving. We previously required trains longer than three cars to have a conductor, but under the new rules, trains longer than 38 feet total (including locomotive) OR with more than 10 passengers have to have a conductor. All incidents must be reported to the Track Manager which includes all derailments and all accidents even if no one is hurt.

The biggest change from the old safety system is in enforcement. We will now be much more pro-active in the enforcement of the safety rules. The purpose is to improve standards of operation on the railway. The track manager or a person designated by him can now go out and test rule compliance by setting up, for example, a speed test or a stopping distance test. The directors have also passed a Demerit System. The Track Manager can now issue demerits for violations of certain Safety Rules, in addition to his other powers. Persons accumulating ten demerits or more will be referred to the directors.

Our season is open and it's full steam ahead. The weather sadly did not smile on our Easter meet. Despite this, we had quite a good time. A good contingent of visitors from Vancouver Island came over

on Saturday, and drove around enjoying themselves. On Sunday many visitors from the States made it up.

The annual inspection of all bridges, tunnels and roadbed turned up no serious problems. When Rogers Bridge was built, it was known that the east end fill had only three years of settling, and so the abutment was designed such that if there was further settling it could be raised. Sure enough, by the start of this year, the abutment had settled 13⁄4 inches, so we lifted it. Amusingly, the jack sank six inches into the fill for every half inch the abutment lifted, but this compaction of the fill is probably all to the good.

British Columbia Soc. of Model Engineers
Location: *Rainbow Creek Station, 120 Nth Willingdon Ave, Burnaby, BC.*
Public Running: *Saturday, Sunday & public holidays, Easter to Thanksgiving*

Casino, NSW

It is great to see the Old Casino Station's waiting room and toilet [the caretakers quarters] sparkle with a new coat of paint and trimmings. The central entrance ticket windows and stationmasters office is next on the list for refurbishment. Three of our junior members helped out in this task and a jolly big pat on the back is in order for all. These juniors do a good job trackside as well and are learning that there are more things to do in running the club than just being a driver. Several hard working members are known to have over exerted themselves securing, delivering and unloading a beautifully made Queensland Blackbutt timber set of book shelves (which all agreed weighed well over 5 tones) to the Old Station Museum. This will allow all those books and magazines to be more safely stored.

There have been some more visits to our track by the boy's from Ipswich and Bribie Island clubs, with their 5" gauge steamers and it appears they have a lot of fun on our rails. There have also been visitors with their locomotives from as far away as Gosford, just north of Sydney over the last two months

Contact our club through the Secretary, Ross Metcalf, PO Box 176, Casino NSW or phone (026663 3319 (ah) or by e-mail:- Stationmaster@casinominirail.com

Pacific Coast Railway Society Inc.
Location: *Cnr Queensland Road and West Street, Casino*
Public Running: *Every Sunday*
Website: http://www.casinominirail.com/

Christchurch, NZ

In April some members met on site with a representative from the City Council to discuss the long-awaited new site. The meeting was most progressive and agreement in principle has been given for the location of the engine shed, steaming bays and a feeder line to the running area. This proposal, which will be before Council shortly, is not the club's first choice but will allow them to begin operating with a 1.1 km track with an option to extend, and to build a boat pond as finance permits.

Several members, along with other model engineers in the South Island attended a very pleasant Easter gathering Hosted by the Gore Model Engineering Society at their track site in Hamilton Park, Gore. The Gore club is centred on the redundant, relocated and refurbished North Gore NZR signal box which was obtained for $100 complete with lever frame and all fittings. The track of around 300 metres is raised 7¼"/5"/3½" on wooden sleepers and double wooden beams in the form of a 'circle' with three straights, including a bridge and a 1 metre deep cutting. Maximum grade is 1 in 70. There were seventeen locos on the track and everyone had a great time in spite of the cold miserable weather which even brought hail and sleet.

Canterbury Soc of Model & Experimental Engineers
Location: *26 Andrews Cres, Christchurch*
Public Running: *1st & 3rd Sundays*
www.csmee.org.nz

Duranbah, NSW

Improvements to out track are still in progress as we unfortunately have to dispense with the extruded aluminium rail and replace it with the usual steel bar section. We have recently purchased a complete private railway and this will allow us to extend our system to approximately one kilometre. It is probable that our club is one of the smallest in the association having only 15 members and 11 working locomotives. We are adding to our storage facilities to accommodate them all because all our locos and rolling stock are stored on site. For those who are not aware, our railway is situated on a man-made island within an existing theme park. The gaue is 7¼" only and we are strictly a hobby club. We welcome visitors with or without locomotives but if you are thinking of visiting please call first on (07)5524 5444

Tweed Valley Miniature Railway Inc
Location: *Tropical Fruit Worls, Duranbah Road, Duranbah*
Running: *2nd and 4th Sunday, no public*

Durban, RSA

Three troublesome trees were cut down and one unfortunately damaged the Western Circle Bridge, since repaired. Some fencing was repaired in front of the clubhouse and next to the small car park gate. The ants ate the post even though they were treated timbers. The intermittent troubles with the flexible traverser were due to perished hoses caused by UV radiation. This was the only suitable hose available on initial installation and now it has been changed to a more UV resistant type. We have had verbal confirmation and now await a written one that our application for the adjoining land between our club and the Scouts has been granted by Durban Municipality. Our 90th Anniversary in 2003 is also very close.

Durban Society of Model Engineers
Location: *Kellaway Hall, 10 Hinton Grove, Virginia*
Public Running: *2nd Sunday*

Gosford, NSW

At last the pipes are in place and the 7¼" riding trolleys have been stored in them. Working on the access road from the storage area to the bottom steaming bay will make the marshalling and use of these trolleys so much easier.

Work has recommenced on additional track work around the Party Station. The addition of a 7¼" track and the conversion of the present 7¼" track to dual gauge will allow all trains working the main station to overtake trains picking up or setting down at the Party Station.

Central Coast Steam Model Co-op Ltd
Location: *Lot 10 Showground Rd, Narara*
Public Running: *1st Saturday*

Harare, Zimbabwe

The Annual General Meeting was held in March and the office bearers were re-elected en bloc so they must have been doing a good job.

A visit was arranged at the end of March to Pioneer Engineering but it was disappointing that so few members turned up because, as was predicted, this turned out to be most informative and interesting. Last August we were privileged to be addressed by Mr Lister Pollard, his subject being Marine Diesels. Mr Pollard has agreed to present a paper on jet engines and hopefully at our August meeting.

In a recent issue of the club newsletter, the *Bulletin*, mention was made of our Mutare member Tom Hodgkinson having an 00 gauge layout. He has now written telling us that as he is no longer on the farm and does not have space at the cottage to which he has moved, the layout has been installed in the transport section of the Mutare Museum. What is more, Tom tells us that 'the museum is planning an extensive railway layout in the same area'. As he says, this is an added attraction to an already attractive and most interesting museum. So if you have occasion to go to Mutare, make sure you allow yourself plenty of time to visit the museum.

To contact the club, contact Hon Secretary/Treasurer Ian Andrews, No 1 St Brelades Close, Borrowdale, Harare, Zimbabwe. Telephone 263-4-882893, fax: c/o 263-4-611619 or 263-4-611610 or e-mail: ianmsme@mango.zw

The Mashonaland Society of Model Engineers
Location: *Rainhill Park, Glenara Avenue North, Highlands, Harare*
Public Running: *3rd Sunday?*

Hastings, Vic

The April All-Comers day was well attended with interesting engines for all to

see and enjoy. The weather was a beautiful autumn day and the updated track coped well. During luncheon (of the usual high standard) people were able to exchange ideas and catch up with what was happening at their respective clubs. BHPWPRS thank all who attended to make this occasion so successful

BHP Western Port Railway Society
Location: *BHP Recreation Centre, Denham Road, Hastings*
Members Running: *3rd Sun. (no public)*

Hobart, Tas

The Hobart Miniature Steam Locomotive Society Inc. (HMSLS) was formed in 1974 to cater for a group of steam and model engineering enthusiasts and has currently a membership of around 20. Although the Society was originally formed to suite the needs of the steam model locomotive fraternity it now encompasses all the range of model engineering including boats, traction engines and stationary engines. The HMSLS has two elevated dual gauge tracks for 3½" and 5". The original 159m track was built in 1977 and is currently being upgraded and modified to include a 2½" gauge track. A more recent, 1982, dual gauge track of 219m was recently refurbished to provide an alternate route for club members.

The highlight of the year was the recent AALS Convention held at Evandale in the north of the State and many members travelled north with their engines to enjoy the company of fellow modellers from all parts of Australia. At the Convention the AALS, at their AGM, approved the HMSLS application to be affiliated with AALS. The Evandale Light Railway and Steam Society are to be congratulated on hosting such a successful event making every visitor feel at home — the HMSLS members who attended were full of praise for the organisers.

Some interstate Convention participants took the time to tour the State and we had many visitors to our running day on the following Saturday — it was really interesting to see different engines on our track and hear the observations of the drivers. We also had the pleasure of the President and Secretary of AALS together with *AME's* Managing Editor, David Proctor, who shared many stories and pearls of wisdom with members.

Like many other sporting and recreational clubs recently, the HMSLS was not invited by its current insurer to renew its Public Liability insurance policy, which had previously been issued through a local broker for many years. The HMSLS ground to a halt and any hazardous activity was suspended until alternate arrangements where found. Luckily the Society was eligible to join the AALS Insurance Scheme and now is a full member.

The HMSLS is located at Flagstaff Gully on Hobart's Eastern Shore some 15 minutes only from the city's GPO. Club running days are on the first and third Saturday of each month commencing at 1pm with each alternate Saturdays given to club maintenance. The HMSLS does not undertake public running and given the current insurance dilemma this is unlikely to change.

Any visitors are most welcome and the Society may be contacted through the Secretary at PO Box 322, Rosny Park Tas 7018 or by contacting President, Derek Sandle on (03)6247 7768 or Newsletter Editor Graham Norman at e-mail: gnorman@southcom.com.au .

Hobart Miniature Steam Locomotive Society Inc.
Location: *275 Flagstaff Gully Road, Lindisfarne, Tas*
Public Running: *None*

Invercargill, NZ

The 2002 "Great Little Train Show" is to be held over the Saturday and Sunday of Labour Weekend, 26 and 27 October. This will allow a fortnight between the Christchurch show and our own and allow extra time for exhibitors from the north to travel home on the Monday. Preparations will begin in earnest in the coming month.

Bevan Wilson attended the Takitimu Mountain Festival at Nightcaps with his traction engine and newly built riding trolley. It was an enjoyable afternoon and the organisers and local kids were delighted that Bevan made it out and provided rides.

The big event this month was the completion of the pond repairs and the very generous donation by members Tom and Donna Frew so that the Society's funds were not entirely exhausted as a result of this project. A number of members brought along their model boats to the April monthly meeting and although nothing was formalised regarding the re-forming of a boating group, there are several new boats under construction, so things are looking good for the future. Those members with boating interests were enthusiastic about the re-emergence of the pond and it looks as though it will lead to re-surge of interest in maritime activities.

Southland Soc of Model Engineers Inc
Location: *Surrey Park, Invercargill*
Public Running: *None*

Maidstone, NZ

The formal Maidstone open weekend and ground level track opening is planned for Wellington Anniversary Weekend, January 18, 19 and 20, 2003.

Very good progress has been made in building the bodywork on the battery electric club locomotive that was regauged from 5" to 7¼" gauge to use on our new ground level track. Brian Shears is building the bodywork in MDF and the work he has done so far is very impressive.

We have now finished, and are using, the storage enclosure we had built under the canopy of our station building. We can leave our club engines and passenger trollies permanently on the track on which they run. It is indeed a blessing to be able to open the door, start the engine and drive off without having to struggle to lift locomotives and trolleys on and off the track.

Maidstone Model Engineering Soc. Inc
Location: *Maidstone Park, Upper Hutt*
Public Running: *Every Sun pm Oct-April*

Mangere, NZ

Waitangi Day 2002 — for the fourth year in succession the Manukau Live Steamers club has run a fun day for hundreds of children with special needs and their families. The train rides were free of charge all day on the miniature railway in Centre Park Mangere.

The 12 locomotives that were hauling the trains varied in size from 1/12th full size up to 1/3rd full size and weighed from 50 kg up to 800 kg. There were diesel, electric and real live steam locomotives all operating. A massive total of 1700 special needs kids and their families were given free train rides throughout the day.

To recognise Graham McCarthy's effort and loyalty to the club over the past many years, the members voted to honour him with a life membership.

Manukau Live Steamers Inc
Location: *Mangere Centre Park, Robertson Road, Mangere*
Public Running: *Every Sunday*
http://sites.netscape.net/manukaulivesteam

Millswood, SA

At long last the lifter, adjacent to the 7¼" gauge turntable, was officially operated with all components in place.

The verandah recently added to the Canteen/Clubroom has proved its worth already, as was noted one Sunday in January, when it rained most of the afternoon. Twenty to thirty people were seated quite comfortable watching the trains go by, completely oblivious to the inclement weather.

On the 5" gauge more of the old "ladder type" track is being replaced with new 25mm x 12mm rail in slotted sleepers, as was done on the section from the tunnel exit to the girder bridge. The outer curve, midway along the driveway, has been replaced measuring approximately 25 metres, levelled and ballasted. The next section for replacement is the curve under the bridge adjacent to Millswood Station. The 20 year old moveable frog points at Millswood Station exit are to be replaced by a conventional dual gauge unit. The first conventional point unit was installed 3 years ago at the extended turnout to Millswood Station. This standard design accommodates the 7¼" and 5" wheel and track standards, both fine scale and narrow gauge, and is equipped with the standard electric point machine controlled by drivers from a trackside button.

South Australian Soc of Model & Exp. Engineers
Location: *off Millswood Cres, Millswood*
Public Running: *1st Sun and 3rd Sat*

Moorabbin, Vic

Resulting from the recent AGM, the new Executive includes: President: Graeme Fedley, Secretary: Graham Plaskett and Treasurer: John Burt. Congratulations to Ron Baneth on his being deservedly voted as a Life Member of the club.

At the gathering in March, we had the Surrey Park Model Boat Club come to talk on the building and running of live steam boats. This group was led by Les Lee who has been building and running boats for six years and, at last count, had 16 finished boats, with more on the drawing board.

The GG group are making good progress with the support benching for the outer gauge 1, plus gauge 0, tracks. They aim to have it operational, at least in part, by the Kindred Societies' Weekend.

On the GLT work continues on track alignment, particular attention being paid to those sections where the superelevation is the "wrong way", i.e. outward instead of inward. Passenger trucks are also being worked on as time and labour permit.

A spraying session has knocked off most of the weed growth through the ELT cuttings and other garden work continues on the southern (Lodge) boundary. Re-arrangement of the machinery in the workshop is underway to optimise the work space. To assist this, all members are reminded to keep the workshop tidy. Design drawings for the stairway for the tunnel access are in hand.

Steam Locomotive Society of Victoria
Location: *128 Rowans Road, Moorabbin*
Public Running: *1st Sunday*

Mudgee, NSW

In March the Greencorp team (an organisation that is funded by the council and employs young people who apply to be on the crew and carry out work, always with an environmental aspect) started work on the tunnel bridge. They will build up the approaches on both sides of the bridge, using railway sleepers to form a retaining wall and then backfilling to produce a nice level slope off the bridge along with a drain which will also take all the rain water run off down to the grass instead of down the cutting and onto the track with the resultant mud build up on the track.

The **Blowfly Rally** was held on the weekend of 20th and 21st April 2002 and it was a complete success. After some worrying times leading up to the rally with cold and rainy conditions, both days were fine and sunny. We had a total of 11 visiting locos of which there were 9 *Blowflys* (including the Blowfly Garrett) and there were two visiting petrol/electric locos. Also there were several locos running, steam, petrol and electric, that belonged to Mudgee members. John Buckley from Tamworth came with his table full of tools and other assorted goodies. During the afternoon several competitions were held to test drivers skills and these were held on the main line at the station. The first was the shunting competition. The idea was to loose-shunt a carriage and have it stop the closest to, without going over, a line marked on the track. Everyone had three attempts at this and the best distance recorded. The winner of this competition was John Seckold from Illawarra Live Steamers with his green Blowfly loco *Justin* with a distance 120 mm from the line. The second competition was the 'go to whoa' one and the idea here was to travel over a set distance and stop within a set area about 12 inches long, without using feet as brakes, in the quickest time. Again everyone had three attempts at this and the best time recorded. The winner of this competition of Terry Bartle from the Lake Macquarie club driving his red Blowfly loco *Myfly* with a time of 7.14 seconds. The third competition held was the slow running one where the idea was to take the longest time to cover a set distance without the wheels stopping turning. Everyone had just one attempt at this and the winner was Terry Bartle from Lake Macquarie driving *Myfly* with a time of two minutes and 15.67 seconds.

The most popular Blowfly by visitors' vote was Ben Armstrong's (Illawarra Live Steamers) *Abi* and the award for the best variation on the standard *Blowfly* design went to Robert Wooley (also from ILS) for his 0-6-0 + 0-6-0 Blowfly Garrett *Pegasus*.

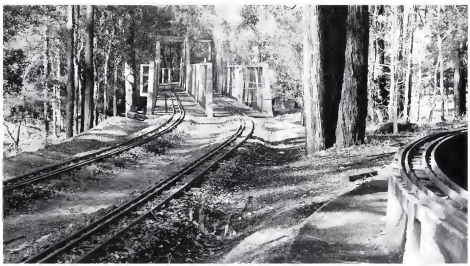
Because we didn't run the official load haul contest on Saturday and we already had the medallion made and engraved, it was presented to Leon and Leal Brack from the Central Coast club when we the *Clisbay* struggling up the grade towards the bridge with a massive load of wagons and dead hauled locos.

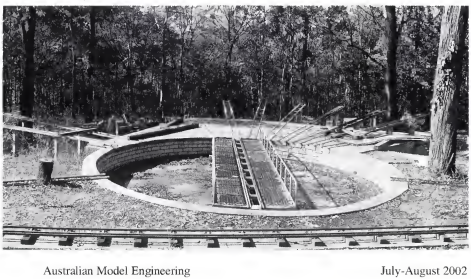
At the end of the Blowfly Rally on the Sunday afternoon, we said our farewells to Mudgee members Roger Barwick and John Maunder who promptly left the tracksite to head home to Willow Tree. About one hour later we saw Roger drive back into the tracksite and then we noticed why he was back. Roger had driven about 40 kilometres and had reached Ulan when he realised that he hadn't hooked his campervan trailer on to his ute and had left it at the tracksite. Good one Roger!

Mudgee Miniature Railway
Location: *Cassilis Road, Mudgee*
Public Running: *2nd Sunday, Easter and Wine Festival*

Warner, Qld

Realignment of the old main line onto the bridge in early April allowed the new line to reach the bridge extension from the





Some of the developments at QSMEE. Above — The bridge is duplicated and the new main line is on the right. Below — new roundhouse site with tracks extended. Photos: Anita McDicken

point in the spiral. Since then progress has been swift with the line crossing the new bridge and well on the way towards our target of extending it to the signal cabin by our 70th celebrations in July 2002. Once this event is over our efforts will be put towards the building of two new overhead bridges to enable the new line to (figure of eight) cross itself and the old main line.

During the May Day holiday weekend, Brisbane hosted the annual AMRA exhibition which according to the programme attracted 111 layouts and trade stands and judging by the numbers that attended it was a very successful show. The exhibitors are to be congratulated on the standard they presented to the public. The enthusiasm shown by young and old alike augurs well for the hobby as it is from the public that the hobby advances.

If you are up our way Warner would welcome a visit from you. Contact the Secretary, PO Box 322 Everton Park 4053.

Qld Society of Model & Experimental Engineers Inc

***Location:** 122 Warner Road, Strathpine*
***Running Day:** 2nd Sunday except Dec. by invitation. No public running*
http://www.steammachine.com/qsmee/

Wodonga, Vic

The last 18 months saw the building of our long awaited ticket box. This was in the form of a sport and recreational grant with input from club with both labour and financial assistance.

Our 5" and 7¼" loop track development is progressing. Several lengths have been completed. Bridge crossings, earthworks and pipes have been buried even though we were set back with theft of the pipes last year.

Our membership has increased during the last six months. It is great to see our younger generation show interest in the hobby.

Kath and Bill Chalmers, Claire and Allan Douglas wish to thank Peter and Dianne Lawson for the great hospitality and dedication at the Easter Evandale Convention. A great time, in a serene, rural setting was enjoyed by all.

Lake Hume Model Engineers Inc
***Location:** Lincoln Causeway, (Hume H'way), Wodonga*
***Public Running:** 3rd Sunday*
http://www.cnl.com.au/users/lhmc/

Farewell

We say goodbye and thankyou to these model engineers who have passed on:

Lindsay Adams (NDMES Balcatta)
Don McFadyen (Tullamarine LSS)
Jack Gregory (Durban SME)
Mike Fitton (Manukau LS)
Jack Jenkins (PCRS Casino)
Bob Smallwood (Mashonaland SME)
Walt Summer (Houston Area LS)

and extend our condolences and best wishes to the family and friends they leave behind. Memories of great friendships and good times will long be treasured

Coming Events

6 to 7 July
The Timbertown Rally — Wauchope, NSW
If you haven't made the trek to Timbertown for a while, this is the time to do it! Steam and Oil Engines, 2-foot gauge steam railway, 5" and 7¼" miniature railway, Tractors, something for everybody! Oily and Steamy web site or contact Ian Strawbridge (President) (02)6587 4455 up to 8pm or Bob Radnidge (Secretary) (02)9918 6430 up to 7pm

3 to 4 August
21st Annual Birthday Run — Narara, NSW
Members of the Central Coast Steam Model Co-op invite you to help them celebrate their 21st Birthday. Saturday is private running to 11am, normal public running 11am to 4pm (visitors need not haul passengers), then private running until 10pm (with BBQ). Sunday is private all day from 11am. 5"/7¼" ground level, raised steaming bays. Don't forget boiler certificates. Char and coal supplied, 240v, 12v and compressed air, overnight security if required, toilets, camping, morning and afternoon tea free, lunch available. Please advise if attending for catering purposes. All welcome. Contact Sec. Edith Bearman (02)4388 2416

4 August
Birthday Run & Swap Meet — Grandchester Qld
Members of Grandchester Model Live Steam Assoc invite all model engineers and interested people to join us at this our first combined Birthday Run and Swap Meet. It is open for Trade displays as well as Individual displays of goods and chattels associated with model engineering. There will be an area to display models under construction. For your FREE site or more information contact Secretary Noel on (07)5464 5031 or 34 Flame Tree Crt, Walloon 4360

31 August to 1 September
NSW Interclub Run — Blaxland, NSW
The Blue Mountains Railway Society is hosting this event on weekend of 31 Aug/1 Sept. Saturday we invite you to enjoy our 600m 5" gauge main line from 9am until whenever. Sunday is our public running day and visitors may run if they wish, but are not obliged to carry passengers. Air (Ryco fittings) and 12 volt are available. Further details from Sec. Jim Auld (02)4739 2904

7 to 8, 14 to 15, 21 to 22 September
Mudgee Wine Festival Invitation Runs
The Mudgee Miniature Railway invites all model engineers and interested people to Mudgee on any of the above weekends to join us for the annual Mudgee wine Festival. Our track is 3½" and 5" gauge ground level and located 6k north of Mudgee on the Ulan/Cassilis Road. Track will be open from 9am on Saturday (no public Sat) with a BBQ tea and night running while Sunday is public running day. There is also ample room to run traction engines, etc. Accommodation in Mudgee can be at a premium during the Festival — you should organize yours as soon as possible. You can camp at the trackside but no power. You can obtain further details on accommodation and local attractions by contacting the Mudgee Visitor Information Centre on Freecall 1800 816304 or (02)6372 1020. Anyone intending to come please contact Secretary, Peter King (02)6373 3626 or write to PO Box 373, Mudgee NSW 2850

28 to 29 September
Invitation Run & Floriade — Canberra
The members of the CSMEE invite to again enjoy a weekend of steam amongst the tulips in the national capital. Track is 5" and 7¼" ground level, swing-nose frog points accept most wheel standards, min radius 13.7m (47 ft). Char, briquettes, steam oil and petrol supplied. If you wish to bring a 3½" engine let us know and we will have our portable elevated track on site. Saturday no public, Sunday normal running day (visitors welcome to run if they wish. Boiler certs a must. Saturday night meal. Ph/fax David Proctor (02)6254 1641

5 to 6 October
Model Engineering Exhibition — Melbourne, Vic
The Melbourne Society of Model & Experimental Engineers are again holding their popular two-yearly exhibition at Monash University, Clayton. With the aim of promoting model engineering in all its forms and providing a venue for model engineers to come together, it is expected that again a large number of clubs and exhibitors will participate. No exhibitors fees as cost will be met by door sales and commercial exhibitors contributions. The large modern well-equipped display area is in the engineering faculty at the university. Contact Bob Jones (03)9801 6048

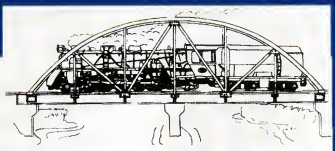
11 to 13 October
Annual Birthday run — Galston, NSW

1 to 3 November
Invitation Days — Wagga Wagga, NSW
This popular annual event is on again. 5" and 7¼" track in scenic surrounds, traction engines, stationary models, historic engines, HO scale layout. Contact David Font (02)6921 4762 or email: dfont@tpg.com.au

16 to 17 November
20th Anniversary Weekend — Bunbury, WA
Members of the SWMEA (WA) Inc would like to invite all club members to our 20th year anniversary at Forrest Park Railway, Blair Street, Bunbury. Saturday will be train running, videos, BBQ and night running. Sunday will be club's public run day for those who wish to stay over. 2½"/3½"/5" elevated track, 5"/7¼" ground level. We will supply char, coal and oil. Contact Secretary (08)9721 2034

The Hamilton Model Engineers

proudly invite you to ..



Steam and STEEL 2004

at Minogue Park, 24 Tui Avenue, Hamilton New Zealand

8th — 12th January, 2004

A tour group is being organised from Australia for January 2004 — Ph. Adam on 0419 344 911

Enjoy 5 days of fun and entertainment in Hamilton!

Track Information

- 1.6 kilometres long comprising 2 separate ground level tracks (3½"/5" and 5"/7¼"). A 7¼" rail is currently being added to the smaller gauge track. Each track offers a choice of routes with many interesting features.
- Each set of points (switches) is driver - operated by lever. Route joining ones are run-through and need no manual change.
- Steaming bays for all 3 gauges are accessible by loading bank, hoist or bridge. Water and power available.

Refreshments/Entertainment

- Drinks continuously available in marquees
- Morning and afternoon tea daily
- Lunch can be purchased each morning
- BBQ every evening except Saturday
- Formal dinner on Saturday evening
- Entertainment each night, fireworks, etc.
- Night running
- Showers and toilets on site
- Outside visits and surprise trips

Besides trains ...

Traction engines will be running, there will be displays of stationery engines, vintage tractors/vehicles and a selection of crafts and models to visit. The original Frankton signal box and a full size diesel loco are on site.

Accommodation

There is a wide variety of accommodation in Hamilton — hotels, motels, camping grounds w/cabins as well as bed & breakfasts. A list is available on request.

Photo: the 1.6 kilometres of track with 2 separate ground level routes and bridges, tunnels viaduct and lake, all in a great setting beside Tranz Rail's Main Trunk Line.

For further information and pre-registration (at no cost) please contact us at:

email
bandvclark@xtra.co.nz
Phone: 64 7 8551 927
Fax: 64 7 8551 307

or write to:
51 Alderson Road,
Hamilton
New Zealand

A Visit to New Zealand

Story and photos by Dick Langford

Noelene and I have just returned from a fabulous four week holiday, in January 2002, travelling around New Zealand. We found many things of interest, both model and full size, to model engineers during our travels in this fascinating country.

New Zealand's roads and railways reflect the nature of the country; deep gorges, many mountains, wild rivers and the like so their bridges are often fascinating. We crossed many of them, by car and train. One bridge we found at Seddon (**photo 1**) is a steel truss type that provides a rail crossing on top of the trusses with a single lane road crossing inside the trusses. World War II Bailey bridges are still in use on major roads (**photo 2**); again in most cases these provide only a single lane for road traffic; we found one over the Waiho River. To avoid mid-bridge brawls, signs indicate which traffic direction has priority. The fundamental road law that "might is right" probably has some weight too. As we drove around the islands in a little Peugeot 205 gti Cabriolet, we didn't put this law to the test! Driving between Dunedin and Christchurch we met three fairly new Foden milk tankers heading in the other direction. No, they were not steam powered, they were diesels. Each rig was a twin steer four axle truck with a four axle (two axles in a front bogie and two rear axles) trailer. This was the most common heavy haulage road transport arrangement we saw. I was thinking about what Foden steam trucks had developed into, when along came another trio of identical Fodens also towing trailers, then more and more. We passed over thirty identical rigs, all heading out to farms to collect milk. At 35 000 litres for each truck-trailer combination that's over one million litres of milk to be collected that evening! How many cows contributed?

A trip on the Taieri Gorge Railway is an amazing experience. This line was started in 1879 to link Dunedin with the new goldfields and farms in the centre of the South Island. Ten tunnels, the longest 437 metres (**photo 3**), and many very delicate looking wrought iron viaducts and bridges carry this railway through the Taieri River Gorge. On these viaducts, you look out of the train and there appears to be nothing between you and the wild river below (**photo 4**). The Wingatui viaduct on this line is 197 metres long and 47 metres above the stream it crosses. This is the largest wrought iron structure in the southern hemisphere, and one of the largest in the world. All the coaches used on the railway have end platforms where you can photograph the scenery. Dunedin railway station is another interesting feature (**photo 5**) This imposing building has recently been restored and is magnificent. The floor of the main entry area is mosaic tiles (**photo 6**), by Royal Doulton, no less, and depicting railway wagons, locomotives and other railway scenes. The building itself is a large bluestone structure and some of the windows

Photo 1

Photo 2

Photo 3

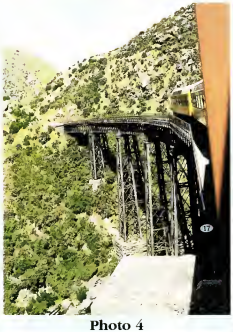


Photo 4

Photo 5

Photo 6

have intricate stained glasswork. At the nearby museum some locomotives, including an 0-4-4-0 Fairlie, are on display.

On the west coast of the South Island we found some more amazing bridges. At Greymouth, the railway crosses the Grey River on a large 265 metre long "S" shaped timber truss bridge (**photo 7**). A bit further south, near Hokitika, the railway shares a river crossing with the road on a narrow single lane bridge (**photos 8 and 9**). No flashing lights or anything; the train just cuts into the road traffic to cross this bridge over the Arahura River! Also at Greymouth, we found "Shantytown", a gold mining era township tourist park that includes a short railway where trains are steam powered. I had a footplate ride on a Climax locomotive here (**photo 10**); this was a novel experience, the locomotive rumbled along with lots of noise and vibration at a quite slow speed.

Near Queenstown, we rode on the *Kingston Flyer* a steam powered vintage train (**photo 11**) that operates on 14 km of the railway that once linked Dunedin, via Gore, to the southern end of Lake Wakatipu at Kingston. This railway track is still exactly

Photo 7

Photo 8

Photo 9

Photo 10

as it was when first laid in 1878. The rails have not been replaced and are 24 foot lengths weighing 53 pounds per yard. The coaches in use today are all pre 1925 and have been well restored. One coach was a British corridor style but the non-compartment side of the coach was just steel pipe and wire mesh (**photo 12**). AB class pacific locomotives now handle the train. Two of these locomotives are available: AB 778, which was built at Addington,

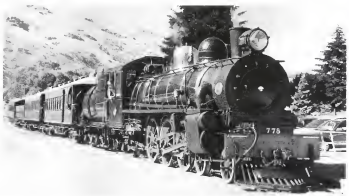


Photo 11

Photo 12

Photo 13

near Christchurch in 1925 and AB 795, which was built at Hillside near Dunedin in 1927.

Driving away from Kingston we spotted an interesting fence around a house. It was made from steel machinery wheels, set in concrete (**photo 13**). Close inspection showed a few of the wheels, including the one with the sign on, to be from traction engines. Other wheels were from agricultural machinery. Not the best way to treat interesting pieces of 1900's engineering in my opinion!

We had seen some strange lineside cranes with large air cylinders at a couple of railway yards and wondered how they worked. At Kingston the mystery was solved. The crane was powered from the locomotive air brake compressor with an air hose fitted to the locomotive buffer beam train pipe connection (**photo 14**). The Westinghouse pump certainly had to work as the crane lifted coal into the locomotive tender.

At Kingston, the train used to meet steamships that sailed up Lake Wakatipu to Queenstown, a 40 kilometre journey. These ships were owned and operated by the New Zealand Government Railways. The first were paddle steamers, and the last was a twin screw steamer which still operates on the lake, tak-

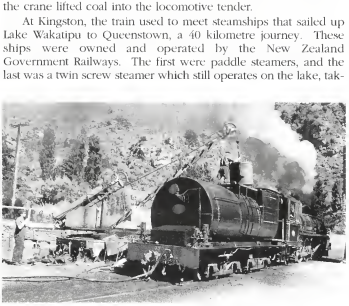


Photo 14

Photo 15

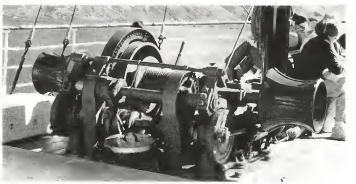


Photo 16 – *Steam winch on the foredeck of the* Earnslaw

ing tourists for sight seeing trips. This ship, the TSS *Earnslaw* is magnificent (**photo 15**); Noelene and I enjoyed a cruise across the lake on it. Two 500 horsepower triple expansion steam engines power the vessel. Steam is generated by two locomotive type boilers that are coal fired and manually stoked. The engine room is open and passengers can walk in on a grid above the engines to watch the action. She was built in 1912 in Dunedin and railed in pieces to the lake where it was assembled. The two paddle steamers were scuttled in the lake; one has recently been located and plans are in hand to raise it and restore it. An engine from one of these paddle steamers is still used in Queenstown to pull the *Earnslaw* up on a slip for regular survey.

We travelled on the Tranzalpine train (**photo 17**) that runs between Christchurch and Greymouth, over Arthur's Pass. 19 tunnels grace this line; the shortest ones are around 50 metres whilst the longest is the famous Otira tunnel which is 8.5 kilometres long. Trains were hauled by electric locomotives through this tunnel from its opening in 1923 until 1997. In 1997, its ventilation was improved and diesel locos now take trains through. All east-bound trains are banked by a pair of diesel locos. It is on a grade of 1 in 33 so trains climb or fall over 300 metres as they travel through it. At the time of its opening this was the seventh longest tunnel in the world. Again, there are many trestle bridges and viaducts on the line. These viaducts are steel and stone or concrete structures and are up to 75 metres high. Thousands of tons of coal are transported over this railway every day. This was another great trip. C Y O'Connor, the engineer who constructed the Mundaring - Kalgoorlie water pipeline, in Western Australia, played a significant role in the establishment of this railway and the west coast ports of Greymouth and Hokitika.

Even the railway that runs down the east coast of the South Island is interesting. It runs from Picton in the north to Invercargill at the south. At Picton it links with the ferries that travel between the two islands. Railway freight wagons are rolled on and off these ferries, a unique facility in Australia and New Zealand. We travelled on the east coast line from Christchurch to Dunedin. The Picton to Blenheim (**photo 18**) and Oamaru to Dunedin sections are particularly picturesque, with lots of tunnels and the railway hugging the rugged coast. We heard that passenger services on this line are sadly to cease shortly.

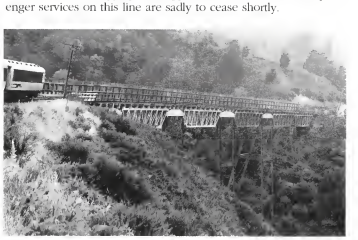


Photo 17

Photo 18 — *Blenheim Station*

In Christchurch we had a look at the Canterbury Society of Model Engineers' current track site and also their new site that they expect to relocate to soon. Their existing track is similar to the Northern Districts Model Engineering Society track in Perth, Western Australia, our home town. Both tracks are a folded figure of eight and are about the same length; 350 metres. The vertical separation between the tracks at the crossover point in Christchurch is less than ours though; only about 1.2 metres, compared with 1.8 metres, this gives lighter grades. A nice boat pond and bitumen road vehicle track are located inside this multi-gauge elevated railway track. The loco handling and steaming bay features (**photo 19**) at this track are very interesting. This track site is surrounded by houses which helps minimise vandalism.

Their new site, at which the club hopes to hold the 2006 convention, is much larger and is located in the Christchurch agricultural showgrounds complex.

The Ferrymead Museum in Christchurch is another fine venue to visit. It has an operating 3'6" gauge railway and an operating tramway system with a range of tramcars from around New Zealand and Australia. A W class Melbourne tram car brought back memories for me. There is also an excellent collection of

Photo 19

Photo 20 — *Ex NZR Wd class loco at Ferrymead*

old fire fighting appliances and many other interesting features at this museum. One locomotive that attracted my attention was a locally built engine (**photo 21**), by Price Engineering I believe. It is a Heisler style locomotive and was used in the New Zealand timber industry.

The Otago Model Engineers Society track in Dunedin is an elevated 2½, 3½, 5 and 7¼" track. It is quite flat and has a tethered car track inside the railway. Their clubrooms are extensive and include a substantial workshop. The club building is two stories with the club meeting room overlooking the track site. Next to this track is the Ocean Beach Railway. This railway is 3'6" gauge and operates on a short length of track. The organisation has some delightful little steam engines, some of which are steamable, and a good range of diesel shunting engines. It has restored some old rolling stock including a hand powered Craven

Photo 21

breakdown crane and a couple of carriages.

At Wanganui, on the west coast of the North Island, we found a very well restored paddle steamer, the *Waimarie*, operating on the Whanganui River (**photo 22**). This 100 foot long vessel was built, for the Upriver Settlers Company, by Yarrow and Co at its Poplar, London, shipyard in 1899 and was shipped in pieces to New Zealand for local assembly and use on the Whanganui River. It was originally named *Aotea* and was renamed *Waimarie* in 1902 when A Hatrick & Co purchased it. In 1952, it sank at its berth in the river. It was salvaged in 1993 by volunteers and recommissioned on 1 January 2000. It still has a classical Yarrow type three drum boiler, this new boiler, built in New Zealand only a few years ago, is dimensionally a very close copy of the original, but is welded rather than riveted and of course, designed to current boiler standards. It operates at 160psi and has a 14 sq ft grate. The engines are original and are located either side of the boiler with the cylinders low in the hull and the crankshaft at deck level. The paddle wheels are direct coupled to the engine crankshaft, as in the PS *Industry* on the Murray River, and turn at about 40 rpm. Passengers are encouraged to ease the fireman's back strain by helping to fire the boiler which consumes about one quarter of a ton of coal per hour. I did not need much encouragement to try my hand at shovelling coal (**photo 23**)!

Photo 22

Photo 23

At Rotorua, we found a miniature railway around a mud lake in a park. This railway was a commercial venture and about 10 inch gauge with a rather battered steam locomotive providing the power. It was not availing itself of the free steam though, it was coal fired. Also on the way to Palmerston North, we explored the Wairakei area where geo-thermal steam is collected to generate electricity. An amazing array of pipes and valves covers the countryside (**photo 24**) where the steam is collected and conveyed to the power station. I was impressed by the expansion bends and kilometres of neatly lagged pipes.

One of the real highlights of our trip was Modex 2002, the New Zealand model engineering convention (**photos 25 to 28**). *(For full coverage see last issue of AME ... Ed.)*. This convention is held every two years in January and in 2002 was at the Palmerston North Model Engineering Club track which is a ground level 3½, 5 and 7¼" track located in a public park.

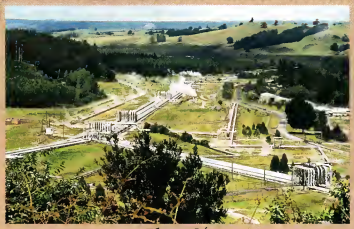


Photo 24

Photo 25 — *Jeff Clifton has a drive of Dave Giles'* Phantom

Photo 26 — *Monty George's 4" scale Fowler traction engine*

Marriner Reserve, in Palmerston North. 43 steam locomotives, 14 petrol or electric locomotives, a couple of traction engines and a steam track and 150 people were registered for the convention. Mary and Jeff Clifton, and Jeanette and Colin Puzey, all from Bunbury, Western Australia, Barbara and Alan Bibby from England, Pat and Ken Brunskill and Margret and Glen Christoffersen from USA and Noelene and I, from Perth, Western Australia, were the only international participants. We were surprised that no other Australians were there.

Locomotives of all sizes, from *Tichs* up to large narrow gauge prototype 7¼" gauge locomotives were run on the track. A 'phlurry of *Phantoms'*, four to be precise (The *Phantom* is a design by Dave Giles of Auckland for a 7¼" gauge early American 2-6-0 locomotive that has featured in *Australian Model Engineering*) were on the track at various times. An interesting selection of models of New Zealand Railway prototypes were run as well. *Simplexes* and other traditional British designs were well represented too. There is a stationary steam museum at

Photo 27 — *an impressive looking 2-6-0+0-6-2 Mallet*

Photo 28 — *Paul Newton pauses for a chat on his NZR C class*

Tokomaru, not far from Palmerston North. A visit to this museum was was included in the Modex 2002 programme and was most interesting. Some large horizontal engines and a few high speed vertical enclosed engines were running under steam. An interesting horizontal steam driven refrigeration compressor was one of the major features. This engine had Corliss valve gear. Each of the New Zealand model engineering societies was given a challenge to build a small traction engine to a set of plans provided, with castings and instructions, by the convention organisers. These were interesting little models. Ken Brunskill and Glen Christoffersen from the United States of America each brought over a beautiful stirling engine powered tractor of similar size. These were all run during a competition segment at the Manawatu Museum and Science Centre in Palmerston North on the Sunday evening. This museum ran a model engineering feature exhibition *Going Loco* from December 2001 through to March 2002.

Our final steam encounter was the Fell Museum at Featherstone. The Wellington to Masterton railway had to cross the Rimutaka Range which provided some very difficult mountainous terrain for railways. In 1873, New Zealand's railway engineers decided that a system providing additional adhesion for a 3 mile section on a grade of 1 in 15 was appropriate for this railway, rather than a considerably longer conventional rail section. They chose the British "Fell" system where the locomotive has two pairs of plain wheels on vertical shafts that grip, under spring pressure, either side of a central rail, in addition to its conventional wheels and cylinders. These wheels are driven by separate reciprocating steam engines. The "Fell" system had proved effective on the Mont Cenis railway in southern France. The Riggenbach rack system had not been proven at this time and the Swiss Abt rack system, which was eventually used extensively in Europe and at Queenstown in Tasmania and Mount Morgan in

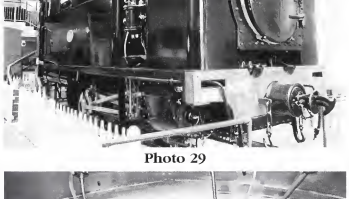


Photo 29

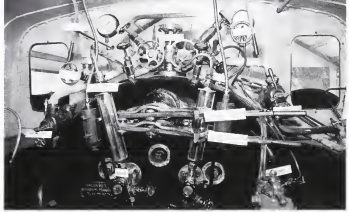


Photo 30 — *In the cab of the Avonside engine in the above photo*

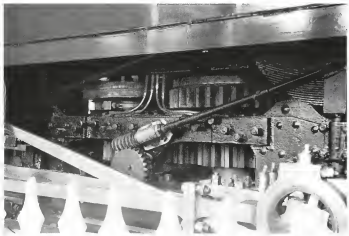


Photo 31

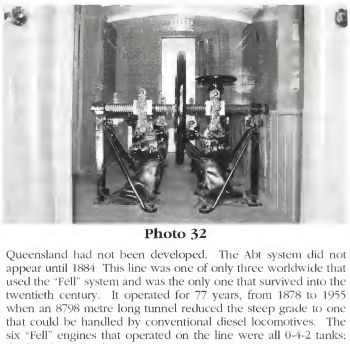


Photo 32

Queensland had not been developed. The Abt system did not appear until 1884 This line was one of only three worldwide that used the "Fell" system and was the only one that survived into the twentieth century. It operated for 77 years, from 1878 to 1955 when an 8798 metre long tunnel reduced the steep grade to one that could be handled by conventional diesel locomotives. The six "Fell" engines that operated on the line were all 0-4-2 tanks; the first four were built by the Avonside Engine Company in 1875 and the last two were built by Neilson and Company of Glasgow in 1886. The Avonside engines weighed 36 tons and the Neilson engines weighed 40 tons, giving them driving axle loads of about 16 tons per axle, the heaviest axle loading of any New Zealand Government Railways steam locomotives.

The first of the Avonside engines has been cosmetically restored (**photo 29**), after a stint languishing in a park, and is now very well presented in a specialised small museum in Featherstone. It is mounted over a pit so visitors can see the central rail gripping system (**photo 31**) and the running wheels are located on rollers so that the engine can be operated. Only the conventional engines and wheels are operated in this display. The first four engines had outside Stephenson valve gear whilst the latter two were fitted with Joy valve gear. As the central rail engines were only needed for climbing and the engines were never turned, simple eccentrics were used to control the valves on these engines. These engines are unique, the connecting rods oscillated from side to side to turn the vertical shafts.

Special brake vans were also used on this section of the railway to control descending trains. These vans had brake shoes that gripped the centre rail. The braking force was applied, by hand, through large screw and lever systems. The brake shoes were changed after every descent. This suggests that they were wood. The locomotives were always distributed through the train to avoid high forces on the couplings. These locomotives had a tractive effort of 22,000 pounds and could pull a train of about 65 tons (excluding the locomotive) up the 1 in 15 grade.

Tracks 'n' Trees

"Back to the Future!"

by David 'Doc' Wescombe-Down

Could it be that O and 1 gauges are re-emerging in popularity? For 50-plus years, these gauges suffered as a consequence of smaller rooms in post-war houses, there being simply not enough room to install a layout of any size or scope. However, given our 'splendiferous' climate, coupled with the advent of 'cashed up' and retiring Baby Boomers (born 1946 to 1960) it is not surprising to see a nationwide growth in smaller scale model engineering *and* garden railway installation.

Even if not a trend, O and 1 gauges are certainly options for those looking to be involved in either, or both, hobby railways and/or model engineering. E & J Winter, in their model engineering catalogue, list ten O gauge ($1^1/_4$") and four 1 gauge ($1^3/_4$") locomotives for which they can supply blueprints and castings. In addition, internet shopping has made direct purchasing from overseas a daily and convenient option — all we need to do is improve our foreign exchange rates!

Journals such as *Engineering in Miniature* and *Model Engineer* have featured articles and projects for both O and 1 gauges over many years.

To help take our new creations outside into the real world, other magazines like *Garden Rail* (UK) and *Garden Railways* (USA) offer useful information, albeit that the primary focus of the latter is LGB.

Websites, such as www.trains.com are also a handy source of information for setting up a garden railway. Their Garden Railway Primer series covers a range of relevant topics such as:

*site plan	*track plan
*earthworks	*ballasting
*wiring	*the trains
*gardening	

which can be readily extrapolated for O and 1 gauges as required.

Extruded brass and aluminium rail is readily available from the UK and USA, and these are easily hand-laid onto marine ply, or outdoor quality solid timber sleepers, cut with a basic bandsaw (such as the Ryobi HBS150I, or its 'big brother', the HBS230L). Brass, stainless steel, galvanised or plated pins may be used to secure the desired track..

Garden Rail magazine, edition 90 of February 2002, pages 35-39, has an excellent article on constructing outdoor tracks, including jig details. *Garden Rail* has a focus on both O and 1 gauges, including articles about coal, gas and spirit-fired live steam, radio control, battery power, track-side accessories, landscaping, bridges and viaducts, rolling stock and new products as they come on the market.

This monthly periodical is available from:

Ms Ann Williams
Subscriptions and accounts
Atlantic Editions Limited
Trevithick House
West End
PENRYN, Cornwall TR10 8HE

and costs 59 pounds for 12 editions at the present time.

For the workshop, there are a number of smaller capacity lathes, milling machines, drill presses, bandsaws, arc and MIG welders, Dremel outfits, compressors with accessories, and soldering stations available to meet the requirements of anyone looking to 'tool up' for model engineering in the smaller gauges.

Given the perennial debate of "big versus small" in model engineering circles, and acknowledging the positives of both, I am content to build and operate what makes ME happy — that is why I practice the hobby, after all. For my wife and I, the smaller gauges have a more practical appeal in our domestic geography. We recently exchanged our 5" locomotive with riding truck for a pot pourri of O gauge items, which we added to our existing collection. Most of the incoming manifest was of 2-rail electric nature, and we are content to mix this with 'home brewed' things to match our expectations for enjoyment.

Present outdoor rails are Peco Streamline in an 28 metre "approximate figure-8" configuration with flyover, but hand laying of brass track in four metre lengths is about to commence for a larger run.

We opted for the change based on three criteria which suited our needs:

1. practicality — those of us over 55 years of age can manufacture AND easily handle, most aspects of O and 1 gauge activity

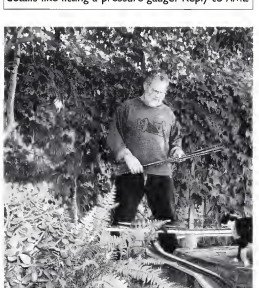
2. selectivity — we are able to operate our railway at any time, day and season that suits us. We can have 'shortie' trains on metre radius curves 'tail-chasing' while the Weber kettle prepares a meal, or we could have 20 metre straights for that interstate express.

3. affordability — we can have a lot more railroad for the same money, in the same physical area, and there is a lot of rolling stock available second hand in Australia should you not wish to build your own (try a membership in the Hornby Railway Collectors of Australia Incorporated. Contact Michael Easey at maeasey@powerup.com.au).

In conclusion, you are not alone — there is a good deal of interest in both O and 1 gauges here in Australia, and there are a number of sources/options for tooling, constructing, setting up, operating, track, 'ready-to-run', accessorising and enjoying model engineering in your own garden. Whatever you choose to do — enjoy!!!

The garden railways column ***Tracks 'n' Trees*** is back after a long absence from our pages. 'Doc' has contributed a couple of articles to kick things off and in the next issue he tell us about the railway he is building in his own garden. We know many of you have made the move to garden railways and we would love to **hear about it?**

Help — does anyone have details on a reliable conversion of the Steamco range of stationary engines from pellet to coal burners, plus any other details like fitting a pressure gauge? Reply to *AME*



A taste of things to come! 'Doc' in his garden

Understanding Superelevation

by Jon Milne-Fowler

In *AME* 93 for November-December, 2000 Kevin Bruderlin writing on Track and Turnout Construction asks if there is a formula for determining the amount of superelevation to use when laying curves on miniature rail track. The short answer is "yes", and the formula quoted by Kevin is one of several variants which have been published.

Before we consider the application of a formula we need to consider the following:-

1. Within limits trains can safely traverse curves which have been laid without any superelevation.
2. There are circumstances, such as encountered within yards, where it is not practical to provide any superelevation.
3. Where superelevation is provided on curves it must be limited to a value which will not be critical for the stability of a train or vehicle which for any reason must halt and stand stationary on the curve.
4. The provision of superelevation on curves is generally desirable to ease flange wear and reduce rolling friction.
5. The maximum safe speed on a curved section of track is dependent on the condition of the track and the state of the rolling stock — wheel wear, suspension, loading and couplings all play a part.
6. The minimum radius of curve for any track is generally considered to be twenty time the longest rigid wheelbase of any locomotive or vehicle which it is intended to operate.
7. The normal radius of curve for the "mainline" is generally 50% greater than the minimum where moderate speeds will usually apply. If it is intended to operate at high speeds it may be necessary to lay curves of greater than normal radius.

To understand the principles applied in determining the amount of superelevation to specify for a curved section of track, we need to consider some basic physics and agree on some definitions.

A body in motion constrained to travel in an arc exerts a force at a right angle to the direction of travel radiating from the centre of curvature. This force is known as centrifugal force and its value varies as the square of the velocity, and inversely as the radius of curvature. This is expressed as V^2/R

If a body is suspended from a radiating horizontal arm by a free pendulum (such as will be found in a Watt governor) the free pendulum will adopt an angle from the vertical dependent upon the angular velocity of the radiating arm. For any value of angular velocity the resultant pendulum angle may be determined by experiment or calculated by application of the appropriate formula. This angle is the equilibrium angle and if extended to the dimensions of a section of curved track will be the same as the angle produced by providing superelevation appropriate to the radius (**R**) and speed (**V**) which corresponds with the angular velocity.

For a given radius of curve and intended speed of operation the equilibrium superelevation may be calculated. The formula published in *British Rail Track* is"-

$$E = 11.82 \frac{V^2}{R}$$

where **E** is equilibrium superelevation in inches:
V is train speed in k.p.h.
and **R** is radius of curve in metres.

Superelevation is measured vertically from the top of the inner rail to the top of the outer rail.

Where track has been laid with less superelevation than the calculated value of **E** the difference is called Cant Deficiency and the maximum allowable has been set at 110 mm for welded track and 90 mm for jointed track.

The above formula may be restated in the following terms:-

$$E = k \frac{V^2}{R}$$ where K = 11.82 for 1435 mm gauge
1.515 " 184 " "
1.046 " 127 " "

or $$E = \frac{W \times V^2}{121.4 \times R}$$ where **W** = track gauge in millimetres.

For miniature railways Cant Deficiency (**D**) should not exceed 7% of track gauge or 12 mm for 7¼" gauge and 8mm for 5" gauge

Taking Kevin's example of a 7¼" gauge track laid to a radius of 50 feet on which it is desired to run at 10 miles per hours, and applying metric equivalents to the equation we get:-

$$E = \frac{184 \times 16^2}{121.4 \times 15.24} \cong 25.5 \text{ mm}$$

Less maximum allowable **D** 12.0 mm
13.5 mm min. superelevation for safe operation At 10 mph

To determine the equilibrium speed for a curve the equation becomes:-

$$V = \sqrt{\frac{121.4 \times R \times E}{W}}$$

And the minimum safe speed may be calculated by using:-

$$Vs = \sqrt{\frac{121.4 \times R \times x (E+D)}{W}}$$

As an example consider a 7¼" gauge track laid to a radius of 60 feet with superelevation of 5/16"

Equilibrium Speed $\mathbf{V} = \sqrt{\frac{121.4 \times 18.3 \times 8}{184}} = 9.8$ kph

and

Max. Safe Speed $\mathbf{Vs} = \sqrt{\frac{121.4 \times 18.3 \times (8 + 12)}{184}} = 15.5$ kph

By a further manipulation of the formula it is possible to calculate the radius required to suit a particular equilibrium speed using a pre-determined amount of superelevation as follows:-

$$\mathbf{R} = \frac{W \times V^2}{121.4 \times E}$$

and for a maximum safe speed the formula becomes:-

$$\mathbf{Rm} = \frac{W \times V^2}{121.4 \times (E+D)}$$

For example an equilibrium speed of 18 kilometres per hour is required on a curve to be laid in 7¼" gauge with a superelevation of 5 millimetres.

Then $\mathbf{R} = \frac{184 \times 18^2}{121.4 \times 5} = 98.2$ metres

As another example consider a 7¼" gauge track where curves are to be laid with 5/16" superelevation and a maximum safe speed of 20 kilometres per hour is required. Assume that Cant Deficiency of 12 mm is allowed then the minimum radius will be:-

$$\mathbf{R} = \frac{184 \times 20^2}{121.4 \times (8+12)} = 30.3 \text{ metres}$$

For those miniature railway enthusiasts who prefer to work in imperial dimensions the following basic formula is published in the book *Outdoor Model Railways* from which I have an extract:-

$$\text{Super elevation} = \frac{G \times V^2}{R \times 20}$$

Where **G** = track gauge in inches
V = average maximum speed in mph
R = radius of curve in feet
and Superelevation is in inches

Due to rounding of the value of the constant (K) as 20, slightly different values will be obtained when compared with the use of the metric formula, but for general applications the formula should be satisfactory.

Glenbrook Vintage Railway

Silver Jubilee Festival of Steam — Easter, 2002

Story and photos by Murray Lane

In 1968 the New Zealand Railways closed the Glenbrook to Waiuku section of the former branch line, some 60 kilometers southwest of Auckland. The Railway Enthusiast's Society carried out negotiations with the NZR, which ultimately led to the formation of the Glenbrook Vintage Railway. 25 years later this immensely popular family attraction celebrated its Silver Jubilee, which runs over the 6 km of unused line between the Glenbrook Station and Fernleigh. Plans are afoot to extend this line a further 2 km past Fernleigh, into the centre of Waiuku.

To help with this celebration, the GVR Charitable Trust Board invited all steam preservation societies and local groups to take part in a festival over a five-day, period during Easter 2002. This momentous occasion duly took place after much organization and proved to be one of New Zealand's best displays of vintage steam power in many years. Rain over the latter days did not stop the public from attending, and the open top wagon was still chosen by many as the preferred car to ride on. Of course the railway items were the main draw card, but there were many other items of interest, including traction engines, tractors, steamboats, model engineering displays, steam preservation displays and various craft stalls, etc.

The major activities were held at the Glenbrook station, with train rides to the other end of the line and back, stopping at Pukeoware where the passengers had around 3/4 of an hour to inspect the workshop and engines that were there. These took turns in running a regular half-hour service during the weekend. Staffs were used to control movement of the trains, on the single track between the terminals at each end of the line.

The following locomotives operated the passenger service:-

NZR Ww 480, GVR number 1, was the first large engine to be used by the GVR, after restoration by GVR volunteers, while it was still at Papakura. This engine was converted from a Wg in 1951. The conversion included a new higher pitched boiler with a deeper grate and an increase in the cylinder bore by 1 1/2" (**Photo 1**)

In 1976 GVR acquired the ex 'Taupo Totara Timber' Alco **Mallet number 7**, GVR number 4, which had been on display at Putaruru for many years. This was restored in the new workshop and was eventually put into service. At the time of the festival it was waiting for an overhaul (**Photo 2**).

J 1250 named *Diana* is owned by Phil Goldman, and leased by the GVR. This locomotive is one of the regular engines for the GVR passenger service.

The visiting engines during the festival were:-

J 1234 from Steam Incorporated based at Paekakariki north of Wellington.

Photo 1 Photo: Robin Russell (courtesy GVR)

Photo 2 Photo: Robin Russell (courtesy GVR)

Photo 3

Photo 4

Photo 5

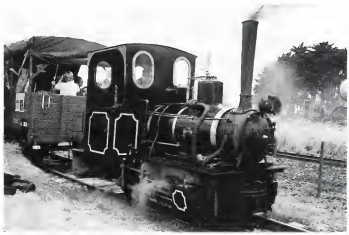


Photo 6

Jb 1236, named *Joanna* is recently restored, and J1211 named *Gloria*, are both from Mainline Steam in Auckland. These two engines have been converted to oil firing by MLS (**Photo 3**).

Ba 552 is owned by Les Hostick, and was stored at Te Awamutu until 1995. It has been leased and restored to main line condition by MLS in 2000 (**Photo 4**).

Rm 4, a replica railcar based on a Model T one ton truck chassis, from the Pleasant Point Railway in South Canterbury.

A free shuttle service was run continuously on one of the sidings in the station area. The smaller engines operated this, with a push me pull you set up at each end of the train, and included:-

NZR Y542, ex Portland cement works number 3, where it was known as the *Shark*. It is now steamed regularly at MOTAT (the Museum of Transport and Technology) (**Photo 5**).

Bertha, a small Orenstein and Koppel built in Berlin in 1904. This locomotive was built for the Kamo Coal Co., and was converted from 600mm gauge to 3 6' in 1918 when it was taken over by the Portland Cement Co. just out of Whangarei, who used it until 1957. It was bought by the Old Time Transport Preservation League and donated to MOTAT in 1962 (**Photo 6**).

A67 a Dubs 0-4-0 from the Ocean Beach Railway in Dunedin. This is the oldest operating locomotive in New Zealand and was built 1873, for the NZR. This little locomotive spent all its life in Otago, and was acquired by the OBR in 1967. Of the 14 engines made 4 are still in steam. It was shipped from Dunedin to Auckland, courtesy of P & O Nedlloyd for the festival (**Photo 7**).

The drivers of these smaller engines enjoyed the longer run on the main line after the passenger services were completed later in the afternoons.

The Pleasant Point Railway **Rm 4**. This immaculate replica of a Model T railcar, representing a 1920's effort by the NZR to provide a passenger vehicle to service lightly trafficked South Island branch lines, was completed in 2000 after 18 years of construction. It carries 12 adults including the driver. It is powered by the smoothest running, electric start, 1925 model T engine, I have ever heard. A very unusual feature of the vehicle, is the ability to be able to be turned around between runs, so that it is always running in a forward direction. Two spreaders are dropped down from under the center of the machine onto the tracks, and then it is pumped up with an in built hydraulic jack until the wheel flanges are clear of the track. It can then be easily rotated 180 degrees. It is then lowered back onto the track and the spreaders clipped back into place under the floor. It takes two men less than five minutes to complete the sequence. Unfortunately the front axle broke on the last run of the festival, but fortunately it was almost at the depot and was not damaged (**Photo 8**).

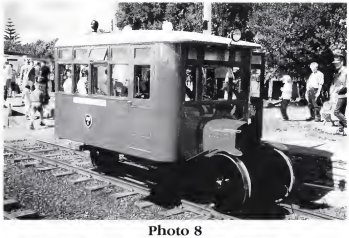


Photo 8

Photo 7

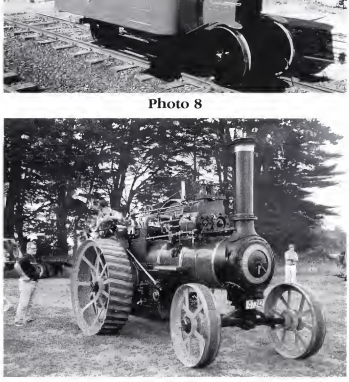


Photo 9

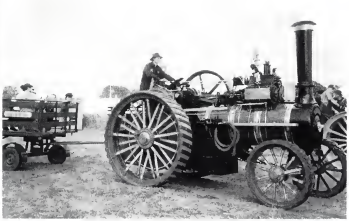


Photo 10

Bill Parker ran his 5" Hunslet *Holy War* on a ground level portable track.

Traction engines included:-

A 1908 compound Marshall number 50670 bought in 1987 by Ward House and Bob Stevenson. The Marshall spent most of its working life in the Hawkes Bay area, as a road hauler and ploughing (**Photo 9**).

A 1903 Foden compound owned by Kevin Hamilton from Maungatawhiri. This 13-ton engine spent most of its working life near Ashburton on the Canterbury plains in general agriculture. Working pressure is 160 psi. and it is fitted with Foden's unique double high pressure system (**Photo 10**).

A three speed single Fowler number 9173 *Princess* owned by Roy Sharman since 1995. Roy is the 14th owner of this 8 NHP 16-ton engine. This engine also comes from the Ashburton area where the boiler was used from 1940 until around 1960 for heating a glass house, after which it required extensive restoration to return it to running order. Peter and Monty George operated *Princess*, while Roy was firing on the locomotives (**Photo 11**).

The 1903 Aveling & Porter number 5324 engine from Hamilton, shown in *AME* issue 96 page 37.

Finally but not least, although smaller, Monty George's 4" scale Fowler.

Steam boats

Two steam powered launches gave rides on the nearby Wymers Dam. *The Gypsy*, an 18' launch owned by Mark Balemi and fitted with a Stuart Turner compound launch engine, had difficulty in the windy conditions. However, Russell Ward's 20' *Rosmany*, with a smaller single engine, had no trouble as it was a heavier boat. Vintage tractors with trailers operated a shuttle service to and from the dam.

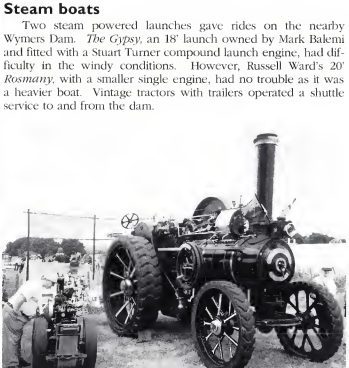


Photo 11

Photo 12

A vintage Tiger Moth owned by John Pheasant of the Tiger Moth Club appeared over the station area many times during the course of the weekend. At times it almost seemed to be stationary due to the very high winds.

Displays

The Auckland Society of Model Engineers had a large display of mainly steam models, including locomotives, traction engines, a steam truck, and stationary engines.

The Manukau Live Steamers displayed two large 7¼" locomotives and a smaller 5" locomotive. **Photo 12** shows Eric Burn's 2-6-2 Sandy River Railway made by Harold Sinclair.

The Scale Marine Modelers display included several steam marine plants, a steam power launch and several other ship models.

A large Hornby 'O' gauge track layout, run by the Hornby Railway Collectors Association, brought back memories to many of the older visitors.

The preservation displays included:-

- The Bay of Islands Railway (Kawakawa to Opua) which has unfortunately gone into decline over the past few years.
- The Toroa Society. The Toroa is an old steam powered ferry, which operated on the Waitamata harbour.
- Pleasant Point Railway.
- The PS Waimarie Steam Boat Soceity, which operates the *Waimarie* on the Wanganui River. See the article by the editor in *AME* issue number 88 page 24.
- The *William C Daldy* Society. This society steams the ex Auckland Harbour Boards steam Tug on a regular basis.
- The Whangaparaoa Railway. A 15" gauge railway built and operated by Ted and Julie Pointon on the Whangaparaoa Peninsular north of Auckland. This little railway is well worth a visit.
- The New Zealand Railway and Locomotive Society.
- The Railway Enthusiasts Society, Auckland branch.
- The Museum of Transport and Technology.
- The New Zealand National Maritime Museum.
- Various musical groups entertained visitors, while having their lunch or generally relaxing, with music from a bygone age, from a stage on the back of a truck.

To take the older folk back even before the days of traction engines, a group of around ten Clydesdale horses gave ploughing demonstrations and rides to the public, behind a large farm cart.

After the last train ride on the Friday, a 'Grand Cavalcade' of locomotives took place, to allow photographers to record all the engines at this unique event.

On Friday night large numbers had to visit John Agnew's SN3½ scale NZR model railway in shifts. The scale is 3' 6" to HO gauge and the setting represents the line from Otira to Greymouth, on the West Coast of the South Island. It is very detailed and is meticulously carried out.

Locomotive Details

NZR No.	Wheel	Builder	Bldrs. No.	Year Made	Boiler Press(psi)	TE Ft Lbs	Weight Tons	B & S Inches	Society
A 67	0-4-0	Dubs & Co		1873	120	2821	11	8 x 15	OBR
Ba 552	4-8-0	NZR Hillside	128/12	1912	200	21200	44.1/22.7	6 x 22	MLS
Ja 1211	4-8-4	North British	24534	1939	200	24960	68.6/40.3	8 x 26	MLS
J 1234	4-8-4	North British	24557	1939	200	24960	68.6/40.3	8 x 26	Steam Inc
Jb 1236	4-8-4	North British	24559	1939	200	24960	68.6/40.3	8 x 26	MLS
Ja 1250	4-8-4	NZR Hillside	373/49	1949	200	24960	68.6/40.3	8 x 26	GVR
Wg 480	4-6-4T	NZR Hillside	104/10	1910	180	14000	52	14 x 22	GVR
Y 542	0-6-0T	Hunslet	1444	1923	160	7885	23	13 x 20	MOTAT
O & K	0-4-0WT	O & K	1411	1904	176		5	$5\frac{3}{4}$ x 10	MOTAT
Rm 4	0-4-0	PPR		2000	N/A	25HP	2.5	N/A	PPR
GVR 4	2-4-4-2	Alco USA		1912	180	8183	48	10/16 x 14	GVR

Photo 13

120 participants enjoyed the 25th Silver Jubilee dinner, which was held on the Saturday night in Waiuku.

On the Sunday night 70 plus enjoyed a $2\frac{1}{2}$ hour evening sail around the Auckland Harbour, which included a barbeque, on the steam tug *William C Daldy*.

The festival was overseen by Ross Crook, the present Marketing Manager of the GVR, to be a FUN event, and was run in a very relaxed manner with the only charges being for the various rides. **Photo 13** shows a view of the station area. As usual the GVR volunteer staff were dressed in period costume and over 7000 train ride tickets were sold, in spite of the inclement weather. The station site turned into somewhat of a quagmire in places necessitating loads of sawdust to be spread around, but the visitors kept coming.

The Glenbrook Vintage Railway operates through out the year during the weekends and on most holidays, so if you are in the Auckland area why not pay it a visit.

Internal Groove Location Gauge

By Brian Smith

Drawings and digital images by the author

No doubt there are a number of fathers out there, perhaps reading this, who have been given 'useful' tools by their young offspring. Tools which, from an engineering stand point, are absolute cheap rubbish but the kids thought Dad could use them and they were within the scope of their pocket money. You make a play of using them but the reality is they remain tucked away where hopefully one's friends and peers won't see them. I've had some. Still do. You see long ago I needed to remove a Phillips head screw with barely a 1/2" headroom. My 'professional quality' angled screwdrivers wouldn't fit. Searching in desperation, more for inspiration than a suitable tool, I came across one of those 'presents'. A screwdriver set seemingly made of chrome coloured copper, the tools were so soft. Well the Phillips screwdriver took a 90 degree bend barely a 1/4" from its business end and got me out of trouble.

Over the years each of the remaining 5 tools has taken on some peculiar but useful form. Collectively those tools have not only worked wonders but taught me to look at such tools in a new light. Sure their material quality and often 'chrome plated' appearance will forever advertise their origins and I admit to tucking them away 'in case Alby sees them'. Or any of my other engineering/hobbyist friends and contacts.

Here is how one of those tools was converted to a practical use. A use which I found a 'normal engineering quality' tool could not be readily adapted to. Sure one could make something of quality from scratch but I do dislike re inventing the wheel in any form so why waste time, unless something is readily purchasable, why not take advantage of what has already been made and redevelop it to one's needs?

This article describes adapting horrible cheap soft metal Vernier calipers to measure the position of internal grooves from the end of a bore. Note 'horribly cheap' means under $7 whereas 'normal engineering quality' Vernier calipers typically start around the $40 mark.

Sketch 1 shows the principle behind the modification and **Sketch 2** applying the tool to the task.

This tool amply covers diameters up to where normal 'engineering' Vernier calipers may suit.

I noted above the impracticality of adapting good engineering quality Vernier calipers. Most, if not all such tools I have seen have relief at the base of the external 'jaws' as shown in **Photo 1**. Modifying the tool as shown in **Sketch 1** would necessitate altering the Vernier scale and fiducial mark to re establish the zero position for correct measurement. Quite an impractical task made more so by the fact that such tools are usually hardened. If you find Vernier calipers without the gap then with great care the tool could be modified by grinding away the unnecessary parts of the jaws as indicated in **Sketch 2**. One would still have to work out how to adapt the depth gauging feeler.

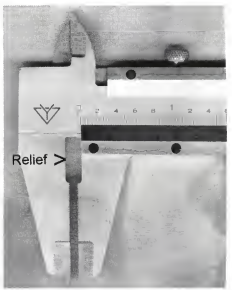


***Photo 1** — 'Normal quality' hardened Vernier calipers showing the relief or 'gap' between the external jaws.*

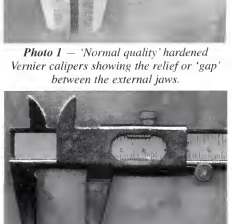


***Photo 2** — Cheap low quality soft Vernier calipers suitable for modification.*

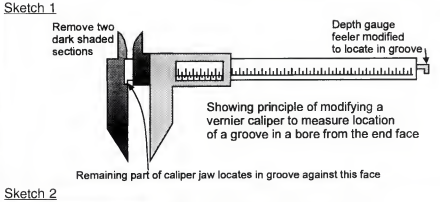
Photo 2 shows an example of currently available (2002) 'cheap' Vernier calipers. The gap is still there but as the tool is not hardened the fixed and both internal jaws can be cut off and an internal jaw offcut rivetted to the end of the scale body and shaped as the groove feeler. See **Photo 3**. I soldered the removed external jaw to the Vernier slide to provide a good wide 'T' seat to bridge the bore of larger work pieces. (Photo 3)

Not shown is the original depth gauging feeler. A length of round wire! This was removed, about 1.5 mm of the end bent over and the end of the scale body filed back to 'zero' the gauging face of the feeler to the scales (**Photos 4 and 5**). This end suits smaller bores.

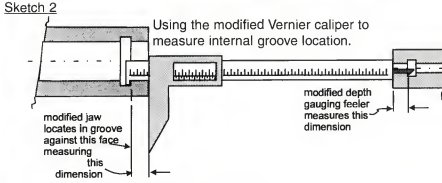
Calibrating the tool to zero

The tool can be used through the bore

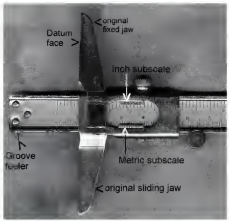
Sketch 1



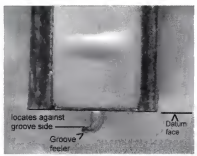
Sketch 2



Note: The depth gauging end of the Vernier calipers is adapted to suit smaller bores, the external end for larger bores.



***Photos 3** (above) and **4** (below) show the modified Vernier calipers. The datum face sits across the end face of the workpiece. (The apparent out of squareness of the 'outside jaws' is an illusion from my scanner possibly generated by the jaws being offset.) Easily seen are the 3 rivet heads securing the new 'groove' feeler in the recessed back of the scale body. (Photo 5 also)*



to check length of a workpiece, for instance, being faced to length. This same attribute presents a simple method of checking and adjusting the tool to zero. More specifically to a known size at some point along the scale. Using any piece of round material with a bore which will accommodate the large and small bore feelers. Select a piece which you can measure the length of to your satisfaction - preferably at least by micrometer.

Measure the same piece with the Internal Groove Location Measuring Tool. Compare the readings and adjust the tool to suit. The feelers or the datum faces can be filed to suit ensuring they are square to the scale body.

The tool in use

The tool illustrated is not my original. Before writing this article I surveyed what was currently available — at least in my locality. This was partly due to the belief that the 'cheapies' were now all plastic and partly to ensure what I wrote could be emulated by others today. The metal example shown has a printed stick-on scale which certainly looks the part. More so than my crudely stamped original. I decided to buy one and rework it for this article and maybe replace the existing tool. The subscales are however still quite crude and too short for close toleranced work. For example the inch scale of 9 graduations allows .010" increments as distinct from the typical .001" of an 'engineering quality' tool. With practice I achieve through bore readings within .003" compared with an outside micrometer . Not fantastic! However as with all tools it is a matter of 'horses for courses'. If the task demands something better then most likely one is faced with making a one off special which may never suit another job.

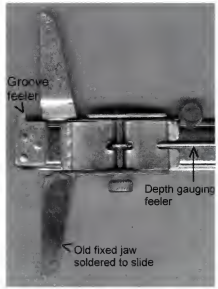


***Photo 5** — Showing the reverse side. The 'top' end of the wire depth gauging feeler can be seen.*

A note on plastic Vernier calipers

Personally I wouldn't bother adapting them. However some can be adapted as shown in Sketch 1 so if they suit you or you can overcome the deficiences of a plastic 'groove feeler' that's up to you. For $2 to $3 you not only save money but get a longer easier to use Vernier scale, graduated to 1/128 inch and .05mm. One wonders why 1/128 of an inch.

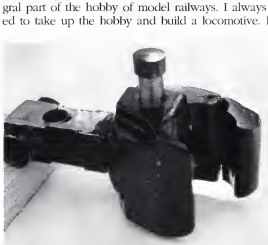
My calculator tells me that 1/128 inch is pretty close to .0078" which is suspiciously close to .2mm especially in plastic.

Automatic Knuckle Type Couplers for 7¼" Gauge

by Stan Kirk

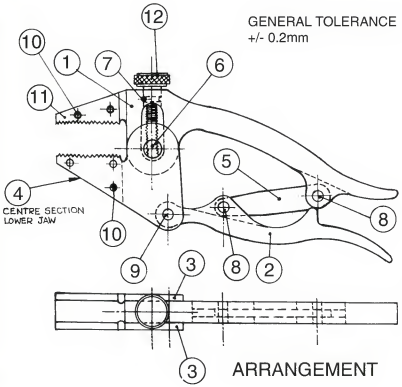
When someone told me that this type of coupler would be difficult to make, they were right. The advise given to me was that it would be easier to purchase them from overseas.

We took up the challenge just for the fun of it and also to see if we could make them as a marketable item. Well, you can forget this idea mainly because the cost is too prohibitive. A lot of time was spent making fixtures to assist in producing the items and also a test rig had to be made to simulate actual shunting together so that the 12 sets of couplers we had completed would automatically couple to each other and disengage when activated. Making an item of this nature I consider as an integral part of the hobby of model railways. I always remember the fellow who decided to take up the hobby and build a locomotive. But first he had to make a power hacksaw for cutting up the material for the loco. atotal waste of time when you consider at the time he could have bought one for around $200. Anyhow the couplers have proved to be highly successful under actual working conditions which now makes the project very rewarding. The couplers are of steel construction and if anyone is considering having a go, then it is essential that you have a first class, fully equipped milling machine. Good luck.



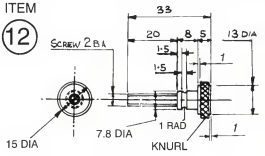
Make Your Own Mole-Grip Pliers

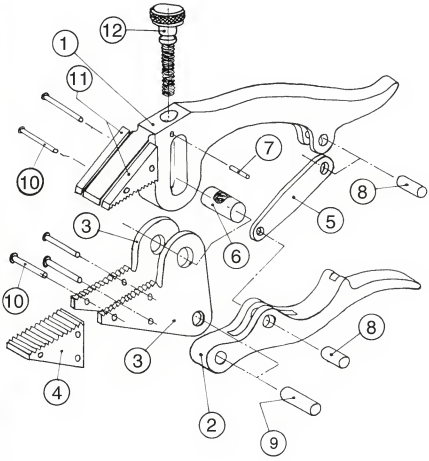
Drawings by Peter Wardle



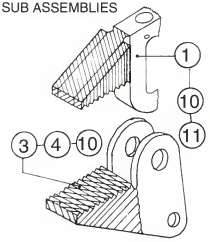
Part No	Part Name	No. off
1	Handle	1
2	Lower lever	1
3	Side plate	2
4	Lower jaw cr.	1
5	Link	1
6	Centre pin	1
7*	Lock pin	1
8*	Hinge pin	2
9*	Hinge pin	1
10*	Rivet	5
11	Jaw side plt.	2
12	Screw	1

* ITEMS NOT SHOWN ON DETAIL DRAWINGS

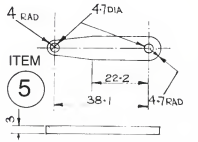


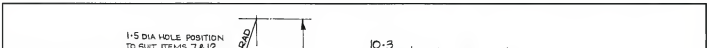


SUB ASSEMBLIES



CASE HARDEN SHADED AREAS




1·5 DIA HOLE POSITION TO SUIT ITEMS 7 & 12
ENLARGED TOOTH DETAIL SEE SKETCH
DATUM
4·7 RAD.
3·2 WIDE SLOT × 10·4 DEEP
SECTION AT A - A
3 × 2 UNDERCUT
10·3 RAD.
7·1 RAD
4·7 DIA HOLE
60° APPROX
ENLARGED TOOTH DETAILS
16 EQUAL PITCHES
4·7 RAD
7 RAD
4·7 RAD
7·9 DIA.
ITEM 1
38·9
143
HOLES MARKED ⊕ TO BE 3·1 DIA.
ITEM 6
TAP 2 B.A.
7·9 DIA
19
SECTION AT 'A'-'A'
14·2 RAD
4·7 RAD
3 RAD
15·8 RAD
DATUM
22·2
58
4·7 RAD
16·6 RAD
63·5
SLOT 3·2 WIDE × 8 DEEP
HOLES MARKED ⊕ TO BE 4.7 DIA
ITEM 2
TOOTH DETAIL SEE ITEM 1
ITEM 4
NOTES
1. DRILL HOLES USING ITEM 3 AS TEMPLATE
2. CUT RTEETH AFTER ASSEMBLY WITH PARTS 3 & 10
7·9 DIA
3 x 2 UNDERCUT
9·5 RAD
4·7 DIA
CUT TEETH AFTER ASSEMBLY OF PARTS 3,4,& 10.
6·4 RAD
HOLES MARKED ⊕ TO BE 3.1 DIA
ITEM 3
2 OFF
ITEM 11
2 OFF
DRILL HOLES USING ITEM 1 AS TEMPLATE.
CUT TEETH AFTER ASSEMBLY WITH PARTS 1 & 10

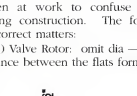
Letter Box

A small rotary engine

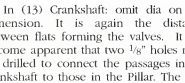
Sir,

Referring to the article *A Small Rotary Engine* in issue 102, it seems that Murphy has been at work to confuse anyone attempting construction. The following should correct matters:

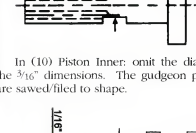
In (6) Valve Rotor: omit dia — 3/16" is the distance between the flats forming the valves.



In (13) Crankshaft: omit dia on 1/4" dimension. It is again the distance between flats forming the valves. It will become apparent that two 1/8" holes must be drilled to connect the passages in the crankshaft to those in the Pillar. The passages at the outer end of the crankshaft must be plugged.



In (10) Piston Inner: omit the dia on the 3/16" dimensions. The gudgeon posts are sawed/filed to shape.



Two items are required with the slot offset as shown, the third has a central slot. This allows conrods to sit side by side.

John Symons
Victoria

(Sincerest apologies to our readers for any inconvenience caused by the gremlins in the original article. A couple of readers who have contacted me had already figured the problems out ... Ed.)

Thanks for the CAD

Sir,

Ralph Byles has done a service to the older generation of model engineers by drawing attention to the existence of the web address www.dcad.com. (*AME* May-June 2002).

I was only introduced to the world of computers and the internet at the beginning of 2001 when our family clubbed together and presented their "ageing parents" with a computer and we subsequently enrolled in introductory TAFE courses. Scanning the magazine section of our newsagent I came across one with a cover disk which included a CAD programme described as "full working version" with an option to upgrade to a newer version at a bargain price of AUS218.00. My priorities did not include spending that much on something which would only be likely to get occasional use; the package did not include a tutorial and I tried without success to find somebody familiar with the programme who might give me some introductory tuition. The programme included a very extensive "Help" section but with no previous exposure to CAD I was groping in the dark. I eventually contacted a user of the system by phone and was given some pointers on where to look. After about five months perseverance I managed to produce a dimensioned drawing of a component! Its not a path I would recommend.

I have now downloaded DeltaCAD and worked through the tutorial which is part of the programme. I have also received a prompt reply to a technical question submitted by e-mail. Using the knowledge gained I have been able to prepare a dimensioned drawing of an item I must fabricate as part of the fitting out of my new workshop. All this within a few days!

Perhaps I should add that my formal instruction in "Mechanical Drawing and Perspective" ceased at the end of 1942 at junior high school level.

Jonathan Milne-Fowler
Western Australia

For 'steamies' on the net

Sir,

I discovered something great on the internet — an online facsimile of an 1874 book about compound steam engines. Perhaps it is Dave Harper's sort of thing (yes, I'm a steamie too). The INNOPAC bibliographic reference appears below. All you do is enter it, and you get to a scan of the whole book, page by page.

Author Mallet, Anatole, 1837-1919.

Title: *Compound Engines.*

Imprint New York, D. Van Nostrand, 1874.

http://name.umdl.umich.edu/AGX0837

Has Dave mentioned to his readers the Baldwin collection at the National Museum library? Its fantastic!

Ian Scales
Canberra

Can you help with a movie?

(Following is an email I recently received from Gates Studio. If anyone out there can help they can email her direct or contact me and I will forward any information ... Ed.)

Hi,

I am currently doing research for an American film and am looking for the name of an Australian toy company that might have issued a simple, wooden toy train and caboose in the 60's. Any information or leads would be greatly appreciated!

Thanks,

Valerie Gates
gatestudio@attbi.com

A sad note from overseas

Sir,

Walt Sumner of Houston, Texas passed away on Wednesday May 1, 2002. He was born Sept 20 1936 in Dallas. He will be known to several Australian live steamers as he purchased a Willis engine which he exported to the USA and ran it regularly at the Browning Planation Railroad, the Houston Area Live Steamers Club track, and at Dr Mark Bing's private railroad. He was a narrow gauge enthusiast with memorials to the Cumbres and Toltec Scenic Railroad in New Mexico/Colorado (6005 Osuna Road, Albuquerque, NM USA 87109).

Fred Springer
Texas, USA

Letterbox Contributions

You are welcome to send letters by mail to:

PO Box 21, Higgins, ACT, 2615 or

fax to: (02) 6254 1641 or

e-mail to: amemag@bigpond.com

As far as possible, *AME* is an open forum for all members of our hobby. Therefore, all expressions of fact or opinion as long as they are not libellous will be considered for publication.

If handwriting please type or clearly print your letters, as script is often difficult to interpret.

News Desk

with David Proctor

Half way through another year already! It gets a bit depressing when I think about what has been achieved in the workshop this year, or should I say, not achieved. Sure, some parts for the Allchin have been produced, but not as many as I had hoped for — but it will get there eventually.

I made a bit of an 'ooops' in the *Club Roundup* section of the last issue. Remember the photo of the lovely GWR Manor on page 48? It belongs to Reg Watters, not Cliff Kirby as stated, but I am sure that Cliff would be quite happy to have it! Sorry about that, Reg.

422 class decals

We have been out of decals for the 422 class diesel loco for some time now. Our previous supplier is no longer in the business and we have not been able to locate a new one. If anyone knows of a person or firm who has the ability to produce these decals (or stickers) from artwork which we will supply, could you please contact me.

Requests for information

I have mentioned this in the past but I think it is worth repeating. I receive many requests from readers (and some not from readers) wanting information which sometimes relates to articles in the magazine and which frequently does not. There are queries about where one can obtain certain products, requests for information regarding how certain machines work, general model engineering help, etc. In fact, two days ago I sat down at the computer and spent a whole day doing nothing but answering requests which had come in by email. Generally, I do not mind helping where I can as I believe it goes with the territory. The reason I mention it is that some people get a bit impatient when I sometimes take a month or more to respond. I simply wish to remind everyone that producing *AME* is a part-time role. I will do the best I can to help between magazines, but during the four weeks it takes to put an issue of *AME* together, all else gets put to one side until the magazine is finished.

Contacting authors

While on requests, I also get numerous requests from people wish to directly contact authors of articles which appear in *AME*. It is *AME* policy not to give out contact details for authors or indeed anyone else without the prior approval of the person concerned. When I receive your requests all I can do is forward them on to the appropriate person and it is then up to them if they wish to make contact with you. I also tend to be mindful of the fact that some of them, if inundated with requests, may decide that writing for *AME* is not really such a good idea. Often it is better to send your query in so that it can be published in *Letter Box* or a *Help* column such as I have suggested in the past.

Can you help?

One of our readers has a query regarding an **arch for the firebox** of a 5" *Nigel Gresley* locomotive. Having already had one which performed well but burnt out quickly, he would like one of longer lasting material, and which is easy to replace.

When the boiler was built 4 large stays were drilled through to take screws and nuts (2 each side), one length of angle bracket was secured to each side and slightly curved flat strips with locating prongs were slid onto the angles through the firebox door. I am sure he has no wish to hack into his boiler so send any suggestions which may do the job to me at the *AME* office. Many thanks.

Another reader is looking for information on **gauge 1** locomotives such as Bassett Lowke. If you have knowledge in this area and are willing to share it, please let me know and I will put you in contact with him.

AME Retail

I have been advised by John and Phyl Oliver that **AME Retail** has just bought in a fairly large range of videos, mostly railway and not NSW (just for a change). This range of videos is fairly cheap by today's prices, I think most are under the $30 mark or thereabouts, and look like good value. **AME Retail** is running a Father's Day special for subscribers on these and there should be a flyer in all copies of this issue of *AME* being mailed out. I am sure that if non-subscribing readers contact Phyl or John they will also get a really good deal.

Two new book titles are also being added to the range, both by well known author and photographer Ron Preston. They are *Day of the Goods Train* and *South Maitland Railways*. If they arrive in time they will also be in the father's Day flyer.

There are other new products coming up for AME retail fairly soon. One of these is a book of the construction series on the **422 class diesel locomotive**. This book will be a similar format to the popular *Bloufly Manual* and is being produced because some of the issues in which the original series appeared are no longer available. Finally, a reminder to check out **AME Retail**'s ad on page 67.

www.ameng.com.au

This is the address of the ***Australian Model Engineering*** magazine's Home Page on the Internet, one of the best sites on the Net. Have you had a look lately? If you are connected this is one of those sites you should visit regularly.

Just look at some of the things you will find there:

- **Current issue** — information on the current issue of *AME*
- **Club listing** — details of all model engineering clubs in Australia and New Zealand
- **Suppliers** — links to model engineering suppliers in Australia and overseas
- **AME Retail** — a full list of available stock with current prices
- Links to **railway related sites** worldwide
- Links to **research sites**
- Links to sites for **Garden Railways**
- **Programs** — downloadable versions of all programs which appear in *AME*
- **Back issues** — listing of available issue
- **Coming events** — details of up-coming events of interest to the model engineer
- **Special projects** — projects for the workshop, these change periodically
- Current **advertising rates**
- **Subscriptions** — you can subscribe to *AME* on line or mail in the printable form

So now you know — the AME Web site is not only a great resource for modellers, it is also your gateway to the wider world of model engineering. Take a look today!

Deadlines

I regularly receive contributions for *Club Roundup* and classified ads after the deadline date. To assist you to know when the cut-off dates are for the next issue, they now appear at the bottom of the *Crew* column on page 5. Unfortunately once the deadline arrives that's it. Once each page is set up I can not go back and make changes to it. If I were to do so we would miss the printer's deadline and then the magazine would come out late — something which has not and will not happen while I am Editor.

There are some guidelines on the next page relating to the use of digital images in the magazine. That's about it for now so I will leave you with this thought, which I saw somewhere: *Get a new car for your spouse — it'll be a great trade!*

David

Digital images — guidelines

You may recall that in *Newsdesk* in the last issue I referred to some of the problems with digital images. As more people are acquiring digital cameras every day it has become important to try for a solution whereby digital images can be published in print to an acceptably high standard. I have researched the subject further and had discussions with the pre-press people at Pirie Printers, the company which prints *AME* and I believe we have the solution.

The digital cameras which most people use produce images with a resolution of around 72 to 90 dpi (dots per inch). Some will go a little higher, but to get a camera with a really high resolution you have to pay out big money at the present time, which most of us cannot afford. Now, when a picture is printed in a magazine or book, a resolution of less than 300 dpi gives an image on paper which is either 'chunky' as individual pixels are visible, or an image which is somewhat fuzzy with no sharp, crisp detail at all. The lower the resolution the more the 'chunky' look. The same image will look perfect on your screen as most screens work on a resolution of 72 dpi (Macs are a little higher at 80 dpi I believe) and anything over this is just wasted on screen anyway.

The solution — With the technology the printers now use a lot more manipulation of images is possible. An image of 72 dpi can, *if the physical size of the picture is large enough*, be compressed down to the published size in a way that the dpi count is increased and the result is a good picture. I have tried this method in two articles in this issue — you will know when I do how successful I have been.

So, if you are using a digital camera the requirements for a good result from publishing your images are:

- Ensure the **focus** of your picture is spot on
- Check for good **lighting** to give clear detail
- Get as **close** to your subject as possible
- Send your images to *AME* as **large as you can possibly make them** by email or on disk.
- Send the **electronic** image — a copy printed out on your printer will introduce another set of problems. If you do send a printed copy send the electronic one with it.

The best images for publishing are from slides or other transparencies, colour or black and white prints and then digital, in that order. Transparencies have lost popularity over recent years and now digital is making inroads into the use of ordinary prints. Our challenge is to make sure we can maintain the standard people have come to expect from AME.

Do Train Wheels Slip?

Q. Down here on the Norfolk and western Railway we've been arguing over what happens to a pair of railroad-car wheels on a curve, where the outside wheel must travel farther than the inside one.

One side maintains that because the wheel edges are tapered they permit the outside wheel to travel further without causing the inside one to slip. The other side (my side) maintains that the inside wheel does slip and that this compensates for the shorter distance it travels.

Could you help us settle the argument?

A. *You're bath partly right. On flot wheels there would be sure to be slippoge. But far yeors oll roilrood-cor wheels were topered an the theary that the autside wheel would ride up an its greotest diometer, while the inside ane would slide ocross to its smollest diameter. This reduced slippoge to o minimum but produced o problem on stroight trock where the wheels would tend to "hunt" ar weove from side to side.*

Believing that this hunting wos worse thon slipping, especiolly at high speeds, the Pennsylvonio Railroad recently storted mokingflot-edge wheels and liked them so much that they ore now using them on oll their cors. Whether other roods will follaw suit nabody knows. Anyhaw, as things stond now, tapered wheels don't slip — at least nat much — ond flot wheels do.

(This question and answer, which appeared in* Popular Science Monthly *in July 1952, was sent in to* AME *by David Mottram).

Classifieds

For sale — Stewart Turner beam engine

- Made in Adelaide from castings some 30 years ago by the advertiser's father. The Stuart Beam engine, without governors but with lubricator, on own base with a clear display cover, comes with a separate 80 psi copper boiler with a vertical copper water tank, hand feed water pump and auxiliary Stuart turner No. 10 twin (non reversing) engine all mounted on a base. A quality attractive display piece. Photos are available and expressions of interest are invited. Reply to P A Hunt, 1/59 St Kevins Ave, Benowa Qld 4217 Ph. (07)5539 5884

5" gauge LNER B1 *Springbok* loco parts

- Full set of castings ex E Winter, Laser cut main frames, Machined tender frames Laser cut brake parts, valve guides, leading pony frames and brake hangers.
  Frames:- Main horns fitted and machined, spreaders and spacers machined and fitted, front and rear beams machined and fitted but not bolted, smoke box saddle and pony base machined and fitted.
  Front pony :- parts machined and centre fitted
  Tender :-Main frames machined and horns fitted and machined, beams machined and fitted, wheels & axles machined & mounted
  Complete as is $2225.00 negotiable
  Also :- Parts duplicated for envisaged second *Springbok*
  Main frames with pony base, buffer beams and spreaders
  Tender frames beams and spreaders
  Wheel castings, horns and bearings
  All laser cut parts as above, Price Negotiable
  Contact (03)5348 3416 or E-mail loco@netconnect.com.au

Model machining services

- Examples:- lathe, milling, tapping, boring. Casting done to you drawings. Supplier of tools, e.g. drills, lathe, milling cutters. For further details write, fax, phone Stephen Palmer, PO Box 95, Windsor NSW 2756. Fax (02)4572 5679, Phone (02)4574 0153

3" Foden castings and plans for sale

- Most work done, inc. tyres, brake shoe. ex. Too many extras to mention $1500.00. 0403 469 961 a/h (07)3889 8272.

Hunslet loco for sale

- 5" gauge 0-4-0, green in colour, copper boiler, includes tender, workshop mobile stands, two 5" bogies, all cleaning & starting tools and accessories. Well maintained. $5,800. Mobile 0402 906 444 or (07)5497 8331

Machining-fabricating capacity available

- Turning, milling, welding, tooling, will tackle anything. Frank Zizza, 6 Elizabeth St. Euroa. Vic 3666. (03)5795 1551

For sale — 59 class 7¼" gauge steam loco

- Copper boiler, cert. Steel wheels, water pump, etc. *(photo on page 31, AME issue 99).* Train also available complete with water gin, two riding trolleys (8' long), PHG wagon, all units vac. braked. Custom built lockable dual wheeled trailer. Hydraulic storage and work stand. $34,000. Ph. (02)4340 1120

Wanted

- Scale NSW 36, 38, 57 — any size, any condition for restoration. (02)9153 9552

Hot air projects for sale

- Horizontal Hot Air Engine kit $110.00
- Vertical Hot Air Engine kit $130.00
- Horizontal Hot Air Engine and 2 Volt Generator kit $140.00
  Each kit has easy to follow drawings and material lists, all metals and fasteners — all you need are the tools. Prices ex Brisbane. Ph. Edwyn Jones (07)3351 4454

Regretful sale — 7¼" steam cane loco

- Loco 99% complete - painted & test run on comp. air
  Copper pipework not yet fitted - most fittings supplied
  Boiler certified, all fittings supplied/tested + 12 mth WHS reg.
  Roller bearing Walschearts valve gear/axle boxes
  Tender underframe and sides complete - needs water tank/bogies
  Drawings supplied & laminated. $11,000 neg. Peter (07)3711 3879

For sale — Toy soldiers

- 54mm 1/32 scale. www.microcredit.com.au e-mailrid@asitis.net.au

Injectors

- One piece brass body construction, beautifully made, 0.9 litre per min. 7/16 x 26 unions. Exceptionally reliable, pick up first time subject to sound plumbing. $80.00 each for one, $150.00 for two. Phone (08)8380 9695 or e-mail: Beekeep1@ozemail.com.au

For sale — '0' gauge rolling stock

- The Big Big Train, 23 gondolas $35 each, 15 passenger coaches $60 each, Lima 3 SNCF triple container flat-cars, 8 tanker wagons, 6 DB/SNCF/SBB passenger coaches, all $60 each or $2500 the lot. David (08)8271 3066 (h) or dwescombedown@picknowl.com.au

Two very reliable locos for sale

- 7¼" gauge steam loco with 2 riding trucks (open wagons) & 4-wheel brake van with lights & auto couplers. 12V. $13,000
- 830 class 'Mustard Pot' with 4 riding trucks (open wagons) & bogie b/van with lights & auto couplers. $14,000
- Spray wagon for maintenance on track & surrounds (with hand wand), stainless steel tank on bogies. $1,200
  2 Dodge starter gen, 1 working, 1 needs attention $250 pr. Ph. Barry on 0427 803 159

7¼" gauge Heidi for sale

- Chassis on air, boiler, tender, most fittings, requires minimal work to complete, excellent club loco. $5,000. Ph. Ian (07)3281 2383

For immediate sale:

- 7¼" gauge guards van, width 1'11", length 6'5", height 1'7", wooden construction & based on SAR NG guards van. $1250.00
- 7¼" gauge passenger wagon (fairground type) width 1'11", length 10'0", height 1'7" wooden construction. $1000.00
  Located at the Diamond Valley Railway, Eltham - both good cond.
- Gangers trolley - Villiers petrol engine (ex VR 1970) Timber & steel frame with tool tray. Adjustable gauge 2'6" - 5'3" (seats 3) As is condition. $1000.00
- Spare Villiers petrol engine to suit gangers trolley (as is.) $250.00
- 2 No. steel boilers (new) for 5" gauge steam loco. Suit 0-4-0 or 0-6-0, as is condition. Unit no.1 $500.00 Unit no.2 $250.00.
  Contact Max Coleman: Tel (03)9885 2110.

Subscribers' Free Market

FOR SALE

Plans, castings and material to build 7¼" Great Western King locomotive. $2,500. Ken (02)4340 1120

EMCO Compact 8 V bed German lathe, excellent condition, metric/imperial threads, 3-jaw, 4-jaw chucks, vertical slide, plenty tooling. Eric $3,000 (07)5536 4928

Castings — complete set of cylinder castings for 5" gauge Bundaberg Fowler. Phone Hugh (03)9749 8642 $200

Stuart Twin Launch Engine kit $425. **Stuart Double 10V** with feed pump plus material for Scotch boiler $1125. Alan (08)8927 3273

Complete sets *Model Engineer* **magazines** 1970-1998 with indexes. *AME* magazines 1992-2001. *ME Workshop* magazines from issue 1. Phone Peter (07)3265 3620

WANTED

Back issues *AME* 1 to 13 inc., 16, 18, 19. Buy or swap for *Model Engineer*. Ph. Neil (07)5441 3338

'0' gauge 32mm track, 7mm/foot scale live steamer, any outline, UK/USA prefer coal fired but others considered. David (08)8271 3066 ah.

Classified rates

- $3.85 (GST incl.) per line as published (including heading).
- Don't send payment with ad, we'll invoice you after publication. No limit to the number of words.

Subscribers Free Market conditions

- Non-commercial only, at the publisher's discretion.
- Maximum of twenty words, including your contact name, phone number or address.
- 5" gauge or larger locomotives (for sale) are not eligible.
- Only one entry per issue

AME Retail

BOOKS

50 Years of the Sydney Live Steam Loco Society	$12.50
A Compendium of NSW Steam Locomotives	$53.85
AME Magazine Index	$20.00
Among Their Favourites**	$48.50
An Era in Steam by Ron Preston	$39.95
Australian Steam Locomotives 1896-1958	$72.00
Australia's Last Giants of Steam, David Burke,	$55.00
Away with Steam**	$28.00
Bridges Down Under (soft cover)**	$44.00
Byways of Steam - 7	$31.00
Byways of Steam - 9	$31.00
Byways of Steam - 10	$34.00
Byways of Steam - 11	$37.50
Byways of Steam - 12	$37.50
Byways of Steam - 13	$42.00
Byways of Steam - 14	$37.50
Byways of Steam - 15	$38.50
Byways of Steam - 16	$42.00
Byways of Steam - Encore	$38.50
Coaching Stock of the NSW Railways Vol.1**	$90.00
Early Diesel and Elec. Locos of the NSWGR	$55.50
Four Decades of Railway Photography**	$37.00
Full Steam Across the Mountains	$36.00
Green Diesels - 40 and 41 classes (NSW)	$55.50
Man of Steam - E.E. Lucy**	$40.00
Motive Power - Dev. of Modern Aust. Locos**	$46.00
On Southern Lines by Ron Preston	$33.00
P Class	$49.95
Rail Scene NSW Vol.12 (soft cover)	$43.00
Remember When	$50.00
Standards in Steam the 50 class**	$51.00
Standards in Steam 53/55 class (soft cover)	$35.00
Standards in Steam 53/55 class (hard cover)	$60.00
Tasmania's Hagans by Geoff Murdoch	$24.95
The 34 & 35 classes	$55.50
The 57s and 58s (3-cylinder power on NSWGR)	$61.00
The Blowfly Manual	$55.00
The Model Injector Explained	$9.00
Tracks in Time	$44.00

** indicates low stock

PSST!

Leave this page open somewhere for your family to see...

Father's Day is coming!

Be quick so we can get the order to you in time

NEW **AMBSC Code Part 1** - Issue 7 - 2001 Copper Boilers $15.00 NEW

AMBSC Code Part 2 - Issue 4 - 1995 Steel Boilers $15.00

AMBSC Code prices do not include postage and packaging

422 class 5" gauge locomotive castings
Cabs: $515.00 per pair.
Bogie frames with dummy brake cylinders: $394.00 per pair.
Cabs and bogies set $905.00.

422 class 5" gauge locomotive drawings
$12.95 if purchased singly or $9.95 if two or more in the series are purchased at the same time.

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